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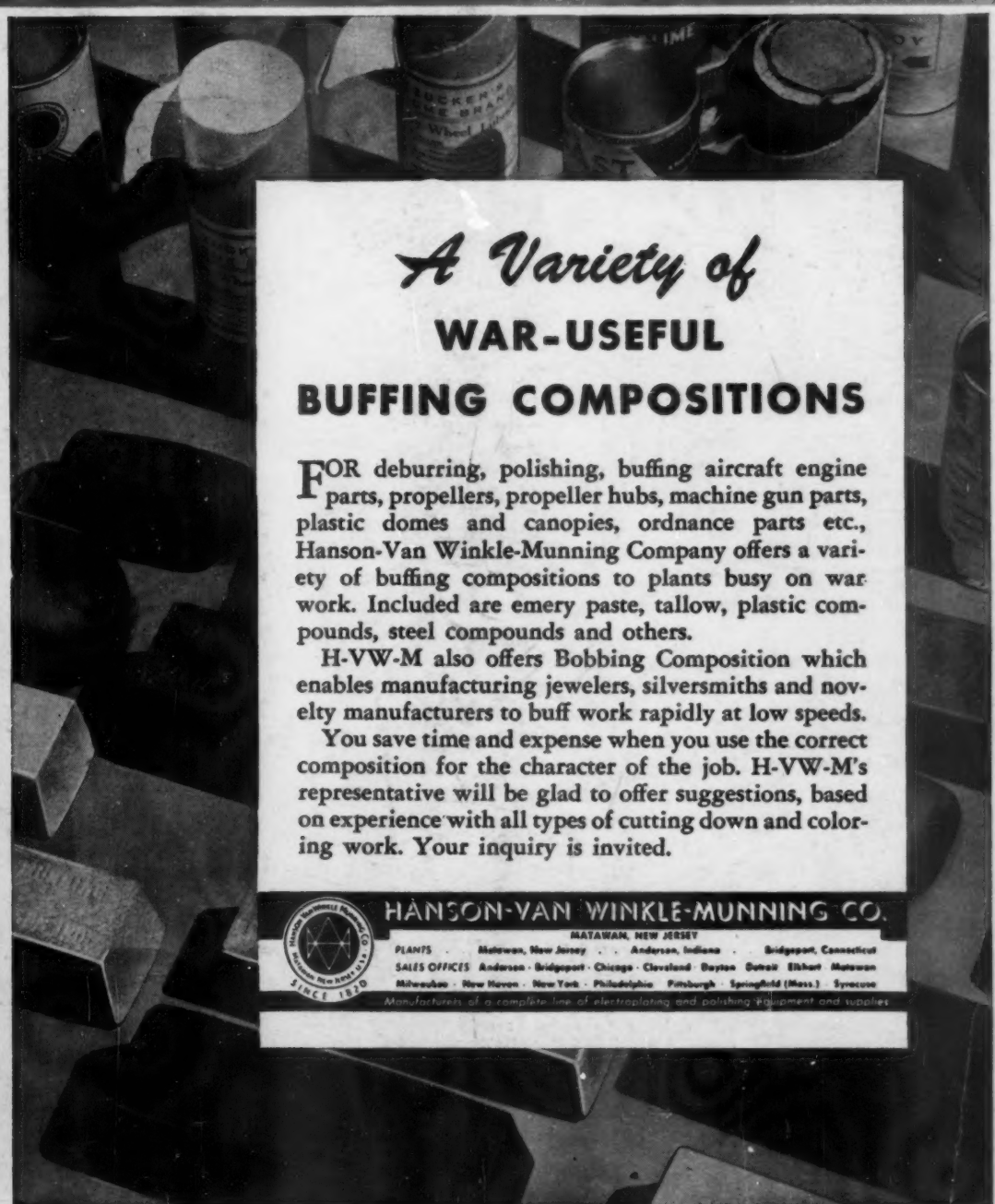

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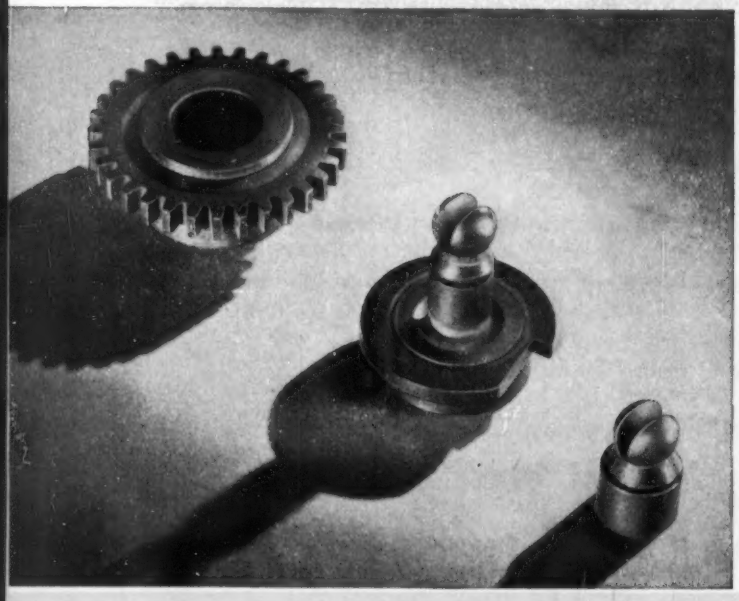

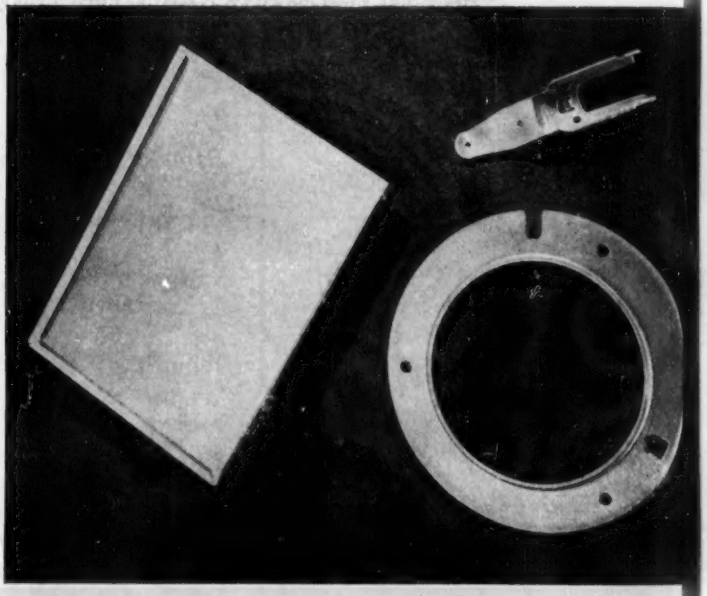

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VOL. 42, NO. 1

METAL FINISHING

PREPARATION, ELECTROPLATING, COATING

JANUARY, 1944

270 MILLION MAN-DAYS

That is the estimate of the time lost during 1943 in American industry, according to the National Safety Council, from a cause which, strictly speaking, isn't even industry's business.

It is time lost by the working men and women of our country as a result of off-the-job accidents—accidents which generally have no relation to occupation and is a problem from which industry as a whole shied away in peace time but which it cannot dodge today.

The situation of a million workers, whose services are unavailable for a whole year, representing enough working time to produce 12,600 large bombers or 63,000 fighter planes or 171,000 light tanks, is one which cannot be ignored in these times of labor shortages.

Industry has done an excellent job of reducing work accidents. Since 1926 it has achieved an average reduction in accident frequency rate of 65 per cent, in severity rate of more than 50 per cent. The council believes that industry can also play an important part in reducing off-the-job accidents.

It suggests that this be done by instituting plant safety programs which emphasize each month the off-the-job hazards prevalent during that month. Thus, during January, the dangers of slippery streets, icy walks and driving on stormy nights can be stressed. Safety posters, leaflets, films, cartoons and articles for plant publications are available in quantities at cost and the council is prepared to assist in the planning of programs.

Off-the-job accidents are costly to industry. Production is lost because of the absence of the injured worker. Time is lost by the supervisor while arranging a replacement and training a new employee. Tools and parts may be damaged by new and inexperienced help. Time is lost by other employees while discussing and thinking about the accident. Money is lost because an injured employee, returning to work, cannot produce at his old rate for a few days, while overhead continues as usual. The major cost, however, is obvious—the slowing up of war production.

Industry, therefore, can serve not only its own limited ends but the whole war effort by making the individual worker and employer realize that the accident toll must be reduced, not only during working hours, but during the leisure hours which are responsible for as much as 90 per cent of accidents.

Technical Developments of 1943

By NATHANIEL HALL and G. B. HOGABOOM, JR.

Associate Editors—Metal Finishing

THE past year showed very little change in the plating metals situation, except for the increasing scarcity of cadmium, which necessitated conversion to zinc plating for most purposes. The conversion, which at this time is being carried out on a large scale, is turning out to be especially troublesome for barrel platers, since their amperage requirements are now just about doubled and in many cases additional current sources must be installed.

Lead plating increased in importance and a number of new sources of supply for fluoboric acid and lead fluoborate became available, obviating the disagreeable and dangerous preparation of the plating solution on the premises. Investigation indicated that this metal, as a protective coating, exhibited some unexpected properties during atmospheric exposure and showed great promise for a number of applications, such as fence wire and pole line hardware.

Tin plating of strip steel on a continuous basis for can stock increased substantially and a number of installations, which are now in operation, were described in the literature. The press of war work did not seem to limit the development of improvements in metal finishing, as was indicated by the large number of patents granted during the year and the industry was fortunate in that many investigators and authorities found time to publish material of great interest and assistance.

Theoretical

The *electrochemistry of corrosion of metals* was discussed by Bulow[1] in a paper which also covered chemical reactions and the formation of protective films. This same subject was also studied by Warner[2] who employed *thermodynamics in the treatment of corrosion reactions.*

Gulbransen[3] applied the transition state theory of diffusion to the *rate of oxidation of metals* as a function of temperature. The author found that the oxidation of iron, stainless steel and copper follows the parabolic law for certain temperature and pressure ranges after a certain initial period.

Polarization studies were made by both Carmody and Rohan[4], who experimented with the *ferrocyanide-ferricyanide electrode as anode and as cathode*, and by Ferguson and Towns, who determined not only the *anode and cathode polarization* but decomposition potentials in acid solutions saturated with hydrogen[5] and with nitrogen[6].

Evans presented derivations of three types of growth laws[7] which express the *rates of formation of films on metal surfaces*, namely the lineal, parabolic and logarithmic.

Anodizing and Corrosion Prevention

Although aluminum is one of the most important metals in the war effort, its surface treatment did not benefit from any important developments during the year. The most interesting development in this connection was by Darrin and Tubbs[8] who showed that very satisfactory *black dyed oxide coatings could be produced on aluminum which had been anodized in the regular chromic acid bath* at higher temperatures and for a longer period than for the usual protective coating.

Anodizing in Wartime was the title of a paper by Wallbank[9] describing the various *procedures for anodizing*, and the *racking of airplane parts for anodizing and chromatizing* was discussed by Sykes[10].

Among the more interesting patents were one on a *basket* for anodizing small parts in bulk, issued to Halvorsen[11] and one on a *special rack*, issued to Miner[12].

During 1942, the enormously increased utilization of corrodable metals for war purposes, where appearance was of no importance and where corrosion resistance was the main requirement, resulted in the predominance of this subject in the technical and patent literature. Coverage of the subject of corrosion prevention during 1943 surpassed that of 1942 by a wide margin, with patents on the treatment of ferrous alloys accounting for a good part of the increase.

The *effectiveness of inhibitors for the protection of aluminum in acid and alkaline solutions* was discussed by Mears and Eldredge[13]. A combination of phosphate, double fluoride and an oxidizing agent was patented by Thompson[14] for providing a corrosion-resistant, paint-holding coating on aluminum.

Jernstedt[15] described a predip containing 1-2 per cent of disodium phosphate activated with a titanium compound, which, when used before phosphating, resulted in *greatly improved corrosion resistance* of the film on iron and zinc. Variations of such predips have also been the subject of a number of patents issued to the abovementioned investigator[16, 17, 18] and to Lum and Jernstedt[19].

Oxide and phosphate treatments for iron and steel were also discussed by Hirdler[20, 21] and by an anonymous author[22] who pointed out the *improvement in the deep-drawing qualities* of phosphate treated steel sheet and gave possible reasons for the phenomenon including the oil-adsorbing power of the films. Various patents on improvements in the phosphating process were issued during the year. Romig received patents on *additions of certain metal salts*[23, 24] and *hydrogen peroxide*[25]. Lodeesen and Ward[26] patented the addition of *materials such as aniline* in a phosphating solution containing bromate to prevent dissociation, and Lodeesen also received a patent on the addition of *permanganate*[27]; Clifford and Adams were granted patents on *nitroso group*[29] and *trichloromethyl group*[30] compounds as accelerators. Patents were also issued to Thompson[31] and to Thompson and Goodspeed[32] on phosphate treatments.

Other corrosion retarding solutions for ferrous metals were patented. Among these were an *acidulated metal nitrate* solution patented by Thompson[33], an *inorganic nitrite plus a wetting agent*, patented by Gordon and Williamson[34], an *acid sulfate and sulfite*, patented by Curtin[35], a solution of *cobalt nitrate and nitric acid*, also patented by Thompson[36].

Organic anti-rust films were claimed for *acyclic aliphatic amines* by Sloan[37], a mineral oil containing a minor proportion of a *dibenzylamine compound* was patented by Howland and TerHorst[38], solutions of *alkali and polyhydric alcohol* such as glycerol and glycol were claimed by Shoemaker[39], *polycarboxylic acids* having at least 16 carbon atoms were covered by Haffner, Siegelman and von Fuchs[40] and *long chain amine phosphates* were patented by Goebel and Walker[41].

On the subject of *protecting magnesium and its alloys*, Parkinson and Cuthbertson[42] found that *alternating current in a weak chromic acid* solution at low current density resulted in a film which resisted sea water corrosion very well. Holman and ApRoberts[43] described the various treatments and practices for corrosion prevention. Among the patents, Buzzard, who in previous years was responsible for a goodly percentage in connection with the surface treatment of this metal, was granted one patent on a method involving *treatment anodically or with alternating current in an alkaline solution of chromate and sulfate*[44]. Patents were also issued to Shawcross[45] for a treatment in a *chromate solution containing basic aluminum nitrate* and to DeLong for a solution containing *chromate and fluoride*[46]. Both of these solutions were stated to be suitable for either immersion or anodic treatment. Four patents were granted to Loose and one to Loose and DeLong for processes involving immersion in *fluosilicic acid*[47], *fluoride compounds plus arsenic*[48], *acid fluoride followed by treatment with an alkali without any intermediate*

rinse[49] and a *fluoride dip followed by treatment with an oxy-acid salt* of certain stated metals[50].

Corrosion prevention of zinc was the subject of one technical article and one patent of note. The *Cronak acid dichromate process* was described in detail by Anderson[51] who showed that hexavalent chromium in the film reduces the corrosion during contact with condensed or stagnant moisture but does not affect the normal corrosion rate during atmospheric exposure and the process cannot therefore be considered a substitute for heavier zinc coatings. Thompson patented a coating consisting predominantly of *oxide of zinc and containing hexavalent chromium*[52].

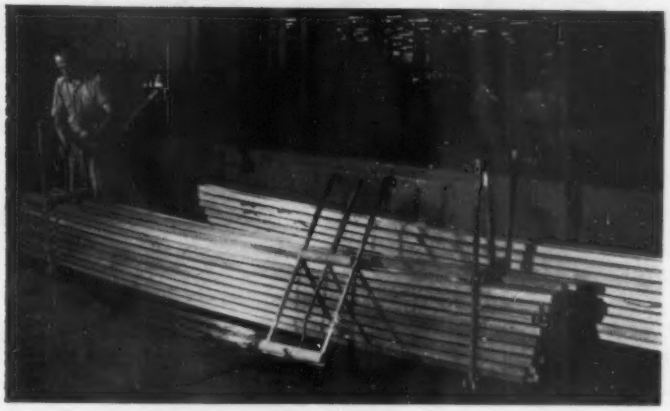
Miscellaneous patents were issued in connection with surface protection treatments, namely one for *tin* involving immersion in an *acidified alkali orthophosphate* to prevent stains and corrosion which was granted to Rath[53], *tarnish prevention of silver* by maintaining an atmosphere with vapors of an amine such as *morpholine* which was claimed by Briggmann[54] and the *application of a wax solution to electrodeposited copper sheet* which was claimed by Macan[28].

Polishing

Despite the lack of emphasis on appearance during the past two years, polishing of metals appears to have been receiving more and more attention in the technical and patent literature. A good deal of this attention is probably due to the close connection between polishing, which is generally considered a finishing process, and deburring, which is usually used as a machining process. The latter is playing a very important part in the efficient production of war implements and the equipment of the finishing department has been brought into play for the purpose.

Wills[55] discussed the *factors governing fine surface quality* and the means by which this quality can be obtained. The various types of *polishing, buffing and deburring compounds* were described by McAleer[56]. *Abrasive cloth gadgets* for polishing difficult parts were the subject of an article by Sid-

Deburring machined parts.



Anodizing long extrusions using "U" type racks. *Courtesy Lockheed Aircraft Corp.*

ford[57] and the *refacing of worn abrasive belts* was the subject of a patent granted to Conrady[58]. Verzier described the *effect of improper handling on the strength of glue* used for heading up polishing wheels[59] and with Jarm, received a patent on an *abrasive faced wheel*[60]; Siefen[61] detailed the use of *mixtures of abrasive grains and liquid cold glue* for polishing, which were to be applied with a brush.

A novel *buffing wheel* was patented by Benbow[62] and an *impregnated fabric polishing wheel* by Twyning[63], the impregnating material consisting of *tricresyl phosphate suspended in sodium silicate* solution. An *applicator for polishing compounds* in paste or semi-liquid form was the subject of a patent issued to Davis[64]. Other patents in the field of polishing and buffing included an apparatus for *drying polishing wheels*, patented by Luzius[65], and two patents to Murray, one for a *buffing machine*[66] and the other for a *polishing machine*[67]. A number of interesting materials for use in *bulk finishing* were patented by Balz and Davidson[68], the applications centering mainly on deburring.

A number of new developments in *electrolytic polishing* were presented during the year, and a very *complete survey* of the subject from both the theoretical and practical standpoints was prepared by Wernick[103] in which a most descriptive comparison was made between the electrolytic attack on the high spots of a rough surface and the smoothing of the surface of a lollypop by continuous licking.

A *chromic acid* solution for *electropolishing rolled zinc and 65:35 brass* was described by Rodda[104] and a *chromic-acetic-sulfuric acid* bath for the same metals was patented by Manuel[69]. Ostrofsky received two patents on *solutions for stainless steels*, containing *citric and sulfuric acids*[70] and the *addition of alcohol* to same in order to prevent crystallizing out of the salts at low temperature[71]; Faust received three patents on *electropolishing iron and nickel and their alloys and nickel silver*, the solution claimed being *sulfuric, phosphoric and perchloric acid mixtures*[72], *sulfuric acid-glycerol mixtures*[73] and *sulfuric-phosphoric acid baths*[74].

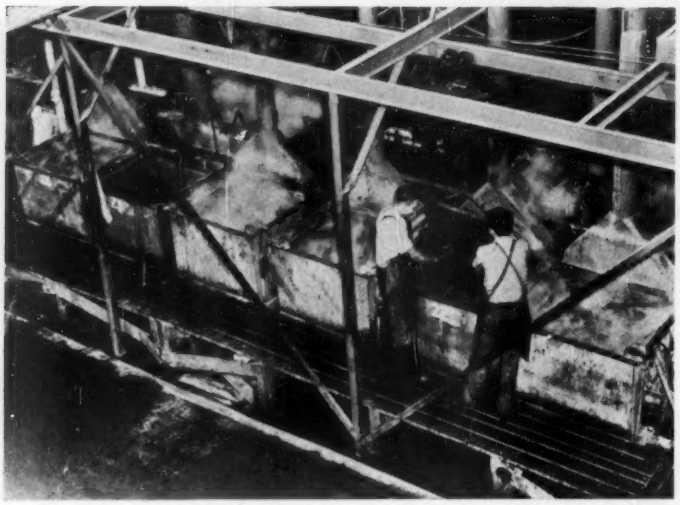
Cleaning

A *bibliography* of articles on the *cleaning of aluminum* was compiled by Harris and Mears[75] consisting of short resumés and comprising a real contribution to the metal cleaning literature. Liddiard[76] described a number of methods for *determining the presence of oil and grease* films on metal surfaces. Rinker[77] presented a paper on the *effects of various anions* in metal cleaners. Linick[78] discussed cleaning briefly, recommending that finishers prepare their own soap by boiling vegetable oils with caustic soda for subsequent addition to their alkaline cleaners. Although it is doubtful whether the number of metal finishers who will follow the author's recommendations in this respect will be sufficient to cause any appreciable decline in soap and cleaner business, those interested may be referred to the preliminary study of the *rate of saponification of fats and fatty acids* which are common to the metal finishing industry, presented by Twyning and Baker[79].

Bellinger[80] listed the requirements of good *washing machines* and Dammers[81] did the same for *solvent degreasers. Degreasing machines* were patented by Phillips and Van Fossen[82] and by Black[83]. Ostrow described a novel adaptation of *vapor degreasers for small parts*[84] which involved the use of an *auxiliary condenser* placed over the work basket to provide flushing of the parts with clean solvent.

In a brief manner, Quadland[85] outlined *industrial degreasing agents*, including alkalies, chlorinated solvents and petroleum solvents. The article also covered their toxicity, availability, cost, explosion and fire hazards. This same subject was also treated by Kahn[86]. Additions to *electrolytic cleaners* were patented by Krogel[87] and by Morgan[88], the former being of interest because of the *use of alternating current* included in the grant. A *combination cleaning and pickling agent* containing sodium bisulfate, diammonium phosphate and a sulfonated phenol or cresol was the subject of a patent issued to Coleman[89]. *Acid cleaners* consisting of fluoride and metaphosphate[90] and fluoride and ammonium dihydrogen phosphate[91] were patented by Brown and Mears.

In the field of cleaning by *blasting with abrasive* a number of patents were issued, the most striking of which covered the use of *ferrophosphorus as a blasting grit* and which was claimed not only to clean but to rustproof the surface[92]. Another patent on a grit blasting abrasive was received by Eash and DeLonge[93], claiming a *cast iron grit* containing small percentages of silicon, nickel and chromium, the nickel and chromium being present in a ratio of about 3 or 4 to 1.



Bonderizing treatment. *Courtesy Buick Motor Division, General Motors Corp.*

A *sand blasting nozzle* was patented by Spenle[94] and various improvements in abrasive blasting equipment, air motivated, centrifugal and water pressure types, were patented during the year by Keefer[95, 96, 97], Blount[98], Rosenberger[99], Webster[100], Voerge[101] and Rasmussen[102].

Pickling

The technical literature had little to offer during 1943 on pickling but there was more activity in the patent field. The Bullard-Dunn process for *electrolytic descaling* was discussed by Bunker[105] who listed a large number of applications. Tatnall[106] studied *hydrogen embrittlement in spring steel* and found that under the conditions of his experiments there was no appreciable difference in effect of sulfuric acid and hydrochloric acid. In hardened and tempered wire, the higher the Rockwell value the more susceptible to embrittlement was the material found to be.

The *disposal of waste pickle liquors* by the "Basin System" was explained by Imhoff[107]. This procedure involves settling, neutralizing the acid and precipitating the iron, followed by filtration through sand beds, but no details were given in the paper on the disposal of the mud. Gehm[108] presented a study of *pickling liquor recovery*, indicating that the addition of equal volumes of acetone to the liquor results in 85% removal of ferrous sulfate and a 71% increase in the acid concentration, the acetone being recovered by distillation. A patent was granted to Hodge[250] on this process.

Marshall[109] was granted a patent on a process for treating the metal with phosphoric acid and a phosphate, followed by heating in a reducing atmosphere at 500 - 700°F. for a sufficient length of time to reduce the phosphorus bearing material and to cause it to be absorbed by the iron or steel surface. Tainton received two patents on the pickling of metals in *molten baths* electrolytically[110, 111]. Wernlund patented an *anodic process in sulfocyanide solutions* followed by immersion in an acid to dissolve the iron oxides[112]. This process was claimed to be suitable for iron and steel wire having lime or other drawing compound on its surface in addition to scale or rust. A patent was granted to Percival for various solutions containing *ferric sulfate*[113] and suitable for pickling copper and its alloys. Coleman received a patent on a *combined cleaning and pickling mixture* containing sodium bisulfate, diammonium phosphate and a sulfonated phenol or cresol[89] and patents were also issued to Dimon[114], Reed[115] and Dishauzi[116] for *continuous pickling of strip steel.*

Coatings

GENERAL

A list of practically all the *books on plating* ever published was compiled by Hogaboom[117] (see revised list in this issue). Hull discussed the present and post-war importance of electrodeposition as a decorative and industrial process[118]; Stedman[119] described *operating cycles for plating of aircraft parts* for various applications. Several novel set-ups for *industrial salvage of machine parts* by electrodeposition were illustrated and described by O. G. Hogaboom[120]. A *stripping solution for nickel and chromium deposits on iron*, consisting of boric and chromic acids, was patented by Hall[121].

Yates[122] reported on the latest developments in the Krome-Alume process for *plating on aluminum*, including the use of ¼% hydrofluoric acid as a modifying dip after anodizing in oxalic acid with alternating current. A somewhat similar process was patented by Blackmun and Mikula[123], the oxide being formed by immersion in an alkali metal carbonate-chromate solution containing an alkali metal chlorate, and being modified before plating by immersion in 50% nitric acid. Ostrow recited the various attempts which had been made in the past to deposit *aluminum on other metals*[124].

The increased employment of zinc plating during the last few months again focused attention on the problem of cooling barrel plating solutions, since higher current inputs are involved for barrel zinc plating than for most commonly used solutions. Eyre described the use of a *heat exchanger for cooling* such solutions and illustrated the calculations required for determination of the exchanger capacity[125]. The properties and uses of *synthetic plating rack insulations* together with their application was discussed by McGee[126] while Bradshaw[127] detailed the uses of *masks made from thermoplastic materials* for plating purposes.

Rectifiers also came in for their share of the attention, the advantages being repeated as usual. Two papers on the subject were deserving of more than passing interest. One by Huenerfauth[128] showed the flexibility of rectifiers for automatic control of a wide variety of current-voltage combinations and the other by Reinken[129] was noteworthy as probably the only article on rectifiers by a rectifier specialist in which the author admitted his prejudice in favor of the product engaging his interest. Such a refreshing admission should not go unheralded and unsung.

One of the most interesting developments in *metal spraying* during the year was its use in *coating small parts in bulk* with zinc as described by Overstreet[141]. With this method, high carbon steel was successfully protected from corrosion without any hydrogen embrittlement, as would be experienced if such parts were electroplated. On large surfaces improved adhesion may now be expected with the development and patenting of a *process of roughening the surface* by a modified arc welding procedure before applying the sprayed metal. Patents on this development were issued to Shepard[142, 143] and to Meduna[144, 145].

ALLOYS

Two excellent articles on *black nickel* plating were offered during the year. Poor[13] studied the *effect of variation in composition and operating conditions* on black nickel and presented his findings with the assistance of some excellent photomicrographs. This paper had some interesting data on the corrosion resistance, composition and structure of the deposits. Moline[131] also determined experimentally the *optimum concentration and operating conditions* of black nickel solutions, finding the most critical constituent to be the ammonium sulfate content which must be at least 4 oz./gal. for a satisfactory plate, lower concentration usually resulting in dull, smutty, non-adherent deposits. From the standpoint of the practical man, Schore[132] discussed a number of black nickel solutions presenting details on *visual control.*

The use of *lead alloys* containing a minimum of 95% lead and a maximum of 2.5% tin *for hot dipped coatings*, as a substitute for zinc was described by Kellogg[133]. Alloys of these two metals were the subject of a patent granted to Stack[134] who claimed an electrolyte consisting of a *sulfone of phenol, cresol, resorcinol and naphthol and an acid solution of the metals.*

Some of the *practical aspects of brass plating* were reviewed by Calabrese[135] and the addition of *calcium and magnesium* to a brass anode to reduce the anode efficiency by formation of an insoluble film, was patented by Ferm and Hull[136].

Other developments in the field of alloy coatings included a study by Lustman on *the decomposition potentials and compositions of electroplates of nickel-zinc* alloys over a wide range of current density and temperature[137], the production of *copper-nickel* alloy deposits (Monel) from alkaline citrate and tartrate solutions containing small quantities of cyanide by Watts[138] and the deposition of *cobalt-tungsten* alloys from a modified Kalmus type cobalt bath by the addition of *sodium tungstate*, which was studied by Holt, Black and Hoglund[139].

Copson and Wesley[140] exposed alloy coatings, *produced by depositing nickel, the*

in, followed by heating, to five typical corrosive canned foods and found that they were anodic to the steel basis metal in four cases and not appreciably cathodic in the fifth. This suggested that the alloy coating may be a potential substitute for heavier tin coatings so that a substantial saving of tin may be possible. The tin content of the alloy coating seemed to overcome the noble potential of pure nickel and takes advantage of the marked inhibiting effect of tin compounds upon the steel exposed at pores, bends and defects in the coating.

CHROMIUM-CADMIUM

As would be expected, the literature on chromium plating ignored ornamental or decorative applications and was concerned only with industrial applications. The details of operation and control of the process for *plating tools and dies* were presented in great detail by Cotton[146]. Baird described the results obtained by *flash coating cutting tools* for 1 minute at 10 - 15 amp/sq. in. without subsequent heat treatment[147]. He found that new taps and reamers cut oversize after being flash plated.

An informative paper in which *thickness values and finishing treatments* for a number of important engineering uses of chromium plate were recommended and discussed, was published by Coyle[148]. The *life of plated and unplated cutting tools* was compared by Fletcher[149]. Hard chromium plating for *salvage of worn parts* and for increasing the wear resistance of tools and dies was discussed by Brams[150] who gave examples of parts so treated, while Logozzo[151] described, with some excellent photographs, a number of typical *production racks* for hard chromium plating various types of articles.

Van der Horst received his patent on the production of *porous chromium*[152], claiming the process of producing this type of surface by a deplating treatment for a short time. The complete process and its applications were discussed by him at the 1943 convention of the American Electroplaters' Soc[153]. Other interesting patents covered a chromium plating process involving placing the plated part in a mass of slowly cooling molten material, issued to Spence[154], and the application of a *flash of fine-grain nickel to electropolished nickel* before chromium plating to obtain a clear chromium deposit, claimed by Pray[155].

During 1943, cadmium was lacking not only in industry but also in the technical literature. Of three articles worth reporting, two concerned themselves with the conservation of cadmium. Soderberg[156] examined and discussed the *substitutes for cadmium* and Tramer[157] presented a *low metal concentration cadmium plating solution* which would conserve supplies. Irenas[158] outlined the *chemistry of cadmium cyanide plating solutions.*

COPPER—MANGANESE—PALLADIUM

The application of *immersion copper deposits* from a special bath for drawing steel cartridges was described by Gardner[159] and the addition of *calcium and magnesium* to copper anodes in order to decrease the rate of anode solution, by formation of an insoluble film, was claimed in a patent granted to Ferm and Hull[136]. The latest development in copper plating was an *alkaline copper sulfamate bath*, patented by Cupery[160].

Steel sheet being lowered into electroplating bath to receive its final coating of cadmium which must be .02" thick to meet specifications. This is 50 times as thick as normal cadmium plate. *Courtesy E. I. du Pont de Nemours & Co.*

Manganese was the subect of a surprisingly large number of patents. Fink and Kolodney[161] were granted a patent on an *insoluble anode* while both Chamberlain[162] and McLaughlin[163] received patents on cathodes.

The *purification of the solution* was the subject of a patent granted to Ambrose[164] and *manganese baths* were claimed by Dean in two patents[165, 166].

The *physical and chemical properties of palladium* were described by Lambros[167] together with the *methods of deposition.* A *chloride bath* containing an appreciable amount of free hydrochloric acid and which was claimed to produce thick, ductile deposits, was patented by Wise and Vines[168].

IRON—LEAD

It was found by Stoddard[169] that the addition of from three to five grams per liter of manganese chloride to the standard ferrous chloride bath acted to *control the grain size* and to *widen the pH and temperature ranges.* Schaffert and Gonzer[170] experimented with the *low temperature iron baths* and determined that deposits less brittle than from the usual sulfate-chloride bath, although not as soft as deposits from the hot ferrous chloride solution, could be obtained from a solution containing *ferrous sulfate, ferrous chloride and ammonium chloride* in specified amounts. An *iron anode*, made of sintered granules and claimed to dissolve electrolytically without formation of loose particles, was patented by Young[251]. One patent was issued on a *hot ferrous chloride bath* containing controlled amounts of ferric ion, the patentees, Wallace and Iler[171] effecting this condition by the use of an insoluble auxiliary anode adjusted to the proper value by a resistance.

Although lead is becoming of increasing importance as a protective coating, the technical and patent literature showed very little to substantiate this well known situation. The *fluoborate bath*, most commonly employed for lead deposition, was discussed in detail by Diggin[172] who specified methods of analysis. Patents were granted to Stack[173] for a *lead-benzene disulfonic acid solution* containing a sulfone, and to Cupery[160] for a *sulfamate bath*, containing sulfamic acid and litharge.

Yonkman[174] described a new process for applying a *pure lead coating by hot dipping*, the adhesion being satisfactory despite the absence of tin in the coating alloy or on the surface of the basis metal. Applied to pole line hardware, the process is eliminating the use of zinc alloys for the purpose and can be employed with hot galvanizing equipment.

COBALT—NICKEL

Employing rondelles containing 98.5% cobalt, Oldach and Linday[175] demonstrated on a laboratory scale the successful *refining* of this metal to a *purity of 99.8%* using a rotating stainless steel cathode and a solution containing cobalt sulfate, boric acid and sodium chloride.

Continuous nickel plating of fine iron wire for electric light leads was described by Conolly[176] and by Conolly and Rimbach[177]. A method of depositing nickel, followed by zinc and heating to an alloying temperature of the two but a temperature insufficient to cause appreciable alloying of the nickel with the ferrous base, was patented by Schoonmaker and Stockton[178]. A patent was received by Loose on a method for *plating on magnesium*[179] which involved the use of a solution of nickel sulfate, boric acid and potassium fluoride.

Deposits of about 400 Vickers hardness were claimed possible by Wesley[180] from a solution containing ammonium ions and nickel and operated at high current densities. A *ductile deposit* produced in a solution containing lead and sodium formate as a carrier for same, was claimed in a patent issued to Baker[181]. Other nickel patents included a *sulfamate bath*, claimed by Cupery[160] and a nickel chloride-boric acid bath for the production of *semibright deposits*, patented by Wesley and Carey[182].

Bright nickel solutions were patented by a number of investigators. The brighteners claimed in the patents were compounds such as *safranine* and *ortho benzoic sulfimides*[183] and *sulfonated naphthalene* and *quinine bisulfate*[184] patented by Lind, Harshaw and Long, *sulfite cellulose waste* and a *salt of methyl naphthalene monosulfonic acid* patented by Hull and Ruebensaal[185], and *materials such as chloral hydrate*, patented by Brown[186].

SILVER

A *high speed silver bath* which could tol-

Gauges, surrounded by coiled wire anodes, being lowered into tank for chromium plating. *Courtesy Westinghouse Electric & Mfg. Co.*

erate cast silver anodes was developed by Schaefer and Mohler[187]. They found that on rotating cylinder cathodes such as bearings, a dense, ductile deposit could be obtained in a cyanide solution operated at relatively high pH and with somewhat high metal concentration. Thin, adherent *deposits of silver could be obtained on magnesium*, it was found by Bowen and Gilbertson[188], with the use of a boric acid-cyanide solution, after proper pretreatment of the magnesium base.

Mesle presented another of his interesting studies of the *adhesion and corrosion resistance of silver plate*[189], making bonding tests on the deposits after heating to temperatures as high as 1600°F. Tests on *steel, phosphated before plating*, indicated that decreased bond and corrosion resistance could be expected. LoPresti[190] found that the corrosion resistance was not improved by the phosphate treatment, which is not surprising, in view of the removal of the phosphate film in the subsequent silver strike solution. Discussion of this paper at its presentation confirmed that what was originally considered to be a phosphate film on photomicrographs was really a metallographic etching effect.

TIN

Lowenheim[191] continued the investigation, originally carried out with Sternfels and reported in 1942, of the *potassium stannate bath*. The effect of changes in bath composition upon operating characteristics of the bath was studied and reported in the new paper. The *stannate bath* installation for *continuous plating of strip steel* at the Crown Cork & Seal Co. plant was described by Cooper[192]. The *electrical apparatus* used on strip tin plating lines for control of the plating and the flowing of the deposit was discussed by Stoltz and Cook[193] and the *present position of electrolytic tin* plating of sheet steel for can production was outlined by Lowenheim[194]. Brighton[195] compared hot dipped and electroplated tin deposits for *food cans*. Although substantial savings of tin are possible the thin electrodeposits are not suitable for many wet packs, it was found.

Among the patents were an *electrolyte for tin plating* consisting of a tin salt, benzene disulfonic acid and a sulfone which was claimed by Stack[134] and patents on the *preparation of the basis metal* for tin plating[196] and for *brightening or flowing the electrodeposit*[197] granted to Nachtman.

ZINC

Various methods of *plating zinc on malleable and grey iron castings* were detailed by Diggin[198], including cadmium flashing, mercury and cadmium in the zinc solution, acid zinc flashing, hot cyanide soaking, tin flashing, high carbonate zinc bath flashing at high current density, immersion in molten caustic soda and anodizing in sodium chloride prior to zinc plating. This article also discussed recent developments in zinc plating, such as the chloride-acetate bath and the Weisberg-Hubbel ammoniacal bath.

Some of the *problems attending cyanide zinc plating* were also discussed by Green[199] and the commercially important methods of electrogalvanizing were described by Bregman[200] who evaluated their *relative merits and disadvantages*. The deposition and testing of zinc electroplated on *strip steel* was the subject of a paper presented by Lyons[201]. A very important development during the year was the presentation of evidence by Page[202] indicating that *zinc must not be allowed to contact stressed steels or stainless steels at elevated temperatures because cracking of the metal invariably results due to the solution of iron by the zinc along the grain boundaries.* Because of this effect, although zinc is being substituted for the more scarce cadmium as a protective coating for most purposes, cadmium is still specified for engine parts operated at elevated temperatures or in contact with components operating at such temperatures.

The principles affecting the amount of *oxide and salammoniac skimmings* formed during hot galvanizing of different products were discussed by Imhoff[203]. The same author covered the *by-products of hot galvanizing* and their quantitative variations under different operating conditions in another paper[204]. Patents were issued on improvements in hot galvanizing practice and equipment to Edge and Wray[205], Bobrov[206] and Ely[207].

Coloring

This field was sufficiently active during the year to warrant representation in this review. A large number of articles were written in connection with the *caustic black process for ferrous alloys*, the *follow through of the process* presented by Hill[208] and the discussion of the process and the *characteristics of the finish* produced by Price[209] being representative. *"Bronzing" steel* by anodizing in a hot concentrated caustic soda solution was patented by Coxe[210].

The four general types of *black coatings which can be applied to non-ferrous metals* were described by Meyer[211] who analyzed the coatings from the standpoint of distinctive characteristics and mentioned the various methods of application. New processes for producing *multi-colored effects on anodized aluminum* were reported by Henley[212].

Watts[213] produced *brilliant multi-colored electrodeposits from ammonium molybdate solutions* and Batcheller received another patent[214] on a process for *coloring stainless steel* with a sulfuric acid solution containing an etching-inhibiting-oxidizing agent.

In a patent issued to DeLong[215], the *coloring of hydrated oxide protective films on magnesium* was claimed for a solution of a dye and an unsubstituted organic carboxylic acid salt such as an acetate. Modifications of the *lactate process for producing electrolytic films of cuprous oxide* on metals were patented by Stareck[216].

Electroforming and Plating Non-Conductors

A number of patents were issued in this connection, although no articles worthy of reviewing were published in the technical literature. *Chemical reduction of silver* to form a conducting film using reducers such as trisnitromethane and 3-nitro-4-heptan-

Thirty-five ounce plating mask believed to be one of the largest injection molded. *Courtesy Dow Chemical Co.*

Examining panels for breakdown of coating in the salt spray test.

was claimed in a patent granted to Tryon[217]. Similar *films of ruthenium*, produced by heating the surface after applying a solution of a ruthenium salt in a suitable liquid were covered in a patent received by Rosenblatt[218]. A machine for *applying graphite* to electrotype and other molds of flat shape was patented by Bungay[219] and a method of forming an *electrically conductive coating* using finely divided particles and a bonding medium and impressing a voltage between two conductors between which the object is placed was the subject of a patent issued to Davie and Halvorsen[220].

Stripping films, which allow the separation of electroformed shells from metal matrices, were patented by Grant[221], who claimed an immersion silver deposit over copper followed by iron plating, and by Schore[222] who claimed a solution containing essentially chloride, sulfate, nitrate and cupric ions.

Testing and Control

A new method for determining the amount of *deposit on tinplate* which involved *electrolytic solution of the tin in acid* containing a known amount of idoine, followed by titration of the excess iodine was presented by Bendix, Stammer and Carle[223]. The *detection of thin gold deposits* by a spot method was the subject of a paper by Werner[224] while a procedure for *the analysis of brass deposits* using a polarograph was developed by Tyler and Brown[225].

In an article on methods of determining *the presence of oil or grease films on metal surfaces*, Liddiard[76] described a very interesting one which makes use of the selective adsorption of dye by superfluous deposits of oil and grease. The solution is prepared by dissolving 2 grams of basic fuchsin in 10 cc. of phenol, warming to moist solution and adding 100 cc. of glycerine, after which 2 cc. of distilled water are added. When this solution is applied evenly to the metal and allowed to remain for about one or two minutes before rinsing off with clear water, it is found that oil and grease stains take on a darker color than the clean metal.

The *use and misuse of the salt spray test*, as applied to plated finishes was discussed by Sample[226] who stated that this test *cannot be recommended for electronegative coatings and does not merit its extensive use in specifications* since the time required for first rust is not as important as the appearance after a given length of time in the test chamber. Most platers have had the same feelings in this connection, but it is doubtful whether the government agencies concerned with specifications will be either impressed or influenced favorably by this report.

Wesley[227] presented data which furnished evidence of the *statistical control and reproducibility of the total immersion* corrosion test, while Hiller summarized the various methods for *control of quality of coatings* used on aircraft parts[228] covering thickness, adhesion, hardness and other tests. Kerr[229] modified the *standard porosity tests* in order to make them suitable for the very thin electrodeposits found on tin can stock.

Tests of the characteristics of plating solutions were the subject of two papers. Young and Zminkoski[230] contributed a method of *testing the throwing power* using a *glass cavity* of definite diameter and length in which is inserted a buffed strip of metal. The depths to which the coating metal is deposited can then readily be compared. MacIntyre and Hull[231] developed a *modified Hull plating cell* of smaller and more convenient size, changing the current density formulas and equations accordingly.

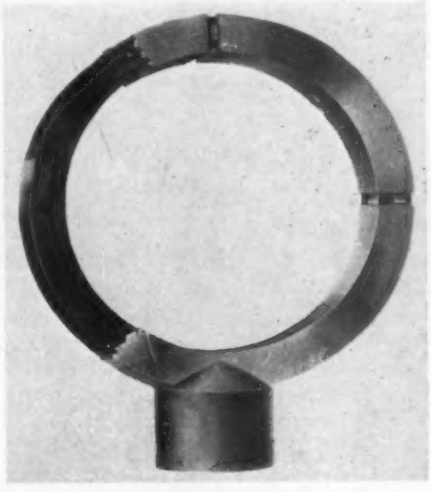
Determination of thickness of deposit also came in for its share of attention. Meyer outlined the preparation of metal coatings for *microscopic examination*[232]. Larkin[233] devised a procedure which was based on the fact that the density of the deposit is different from that of the basis metal. He determined the weight and the volume after plating and from these figures plus information on the density of the deposit and of the basis metal was able, in a number of cases, to estimate the thickness of the deposit. Stoddard[234] improved the *Jet or Drop test* method by *substituting a burette for the usual solution reservoir*. After the tip had been adjusted to give the proper flow rate, the amount of solution used, as read from the burette, indicated the thickness without the use of a stopwatch. Two pieces of *apparatus* were patented for the measurement of deposit thicknesses, one by Anderson and Manuel[235] on an *electrolytic stripping device*, and the other by Tait and Chalmers[236] on an *electromagnetic device* for magnetizable basis metals.

Miscellaneous

The application of *scientific management* to the plating room was discussed by Haas[237]. This is a field which could benefit from more attention. Hall and Hogaboom[238] made their *annual survey of the technical and patent literature of* 1943. Tracy, Thompson and Freeman[239] studied the *atmospheric corrosion of several brands and types of copper* and found them all to have practically the same reaction. Engel[240] contributed a paper on the *language of colors* and their application to aluminum and magnesium.

The proper *design of exhaust systems* was detailed by Kane[241]. The *finishing of stainless steel* by pickling, polishing, passivating and plating was the subject of an article by Olphie[242], and the *use of glycerine* in various metal finishing operatings was described by Leffingwell and Lesser[243].

A variety of miscellaneous patents in connection with metal finishing were issued during the year. A *built-up anode* was patented by Wellman[244], a *bipolar electrode*, such as was described by Savage in 1942, was



Polystyrene loop showing the antenna coil in its housing before and after plating with the desired thickness of metal. *Courtesy Metaplast Corp.*

the subject of a patent granted to Olsen[245] and an *anode bag* impregnated with a suitable plastic for a short distance from the top was claimed by Diggin[246].

An improved *plating barrel* was patented by Mercil[247] and two *plating racks* were involved in patents issued to Wick[248] and to Werrett[249], the former claiming a frame for plating one surface of cylindrical parts and the latter for inside and outside plating.

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HISTORICAL PATENTS

The Forerunner of the Salt Spray Test

One of the oldest patents on the protection of metals against corrosion is British Patent No. 2849, *dated May* 18, 1805, and issued to Charles Hobson, Charles Sylvester and John Moorhouse. It is entitled "A method of sheathing ships, roofing houses and lining water spouts with a material not theretofore used for those purposes" and describes a process by which zinc may be rolled into sheets, so as to become fit for the purpose indicated in the title. However, that portion of the invention which comes within the scope of the metal finishing industry relates to the nails, bolts or other metallic fastenings by which the sheets of zinc are to be secured to the ship's side or other surfaces to be protected.

The inventors state as follows: "The best general rule or instruction for applying metal as fastenings for zinc or spelter sheathings, or for ships intended to be sheathed, is to take that metal which is nearest in that power which chemists call *galvanisin* to zinc or spelter itself, and causes the least quantity of oxydation when made with zinc or spelter into a galvanic pile. Iron and tin are metals of this description, *and those among metals in general are to be preferred of which a piece being laid in salt water, in contact with a piece of zinc or spelter, is found to produce the smallest change in the zinc or spelter in any given time.*" Copper is excluded from the metals that may be used for the above purpose, doubtless because it was found on experimenting, as described, to accelerate the oxidation of the more positive metal zinc, *when the two were kept in contact under sea water.*

It is stated that "the nails may be of iron coated with zinc or spelter, or with tin." When it is thought needful to fasten the plates more closely to each other, the same may be done by a solder composed of tin and zinc or spelter, or a solder of *tin and lead.*

Zinc Deposits by Immersion

According to British Patent No. 7742 granted to George Richard Elkington and Oglethorpe W. Barratt on *July* 24, 1838, and entitled "Covering and coating certain metals", a copper and brass may be coated with zinc by immersion in a boiling solution of chloride or zinc of a certain strength in which is zinc in powder or in thin pieces. The articles to be coated are to be put into contact with the metallic zinc thus setting up electrical action.

To coat with zinc articles of iron or steel they are first coated with copper to fit them for the above bath. This is done by dipping the previously cleansed articles in a cold solution of blue vitriol for a few seconds repeating the process as often as required with intervening washings.

It is found that the zincing process, whether for coppered steel or for copper articles, is facilitated by dipping the articles, before immersion in the zincing bath, in a dilute solution of nitrate of mercury.

This process, it is claimed, can be used for coloring iron or steel to imitate brass.

Galvanic Paints

British Patent No. 7355, issued to Henry William Cranford on *April* 29, 1837, claimed a process for "Coating or covering iron and copper for the prevention of oxidation."

A coating of zinc is employed which may be covered with a second coating of tin, or of tin alloyed with lead. No electrical process is involved in effecting the coating with zinc or tin, or with the two metals successively. The zinc coating may be applied either by means of fusion, or as *galvanic paint,* which is composed of zinc powder well ground and mixed with substances generally employed for painting; or, with the oils distilled from coal tar or coal tar itself mixed with spirits of turpentine.

A disclaimer was later filed in which the *galvanic paint* is disclaimed, restricting the invention to the mode of coating copper and iron for the prevention of oxidation by immersing them in molten zinc, having the surface covered with salammoniac.

Conditioning of Greaseless Abrasive Compounds at −20°F.

By H. SEMAN PAYNE

Chief Chemist, Wadsworth Watch Case Co., Dayton, Ky.

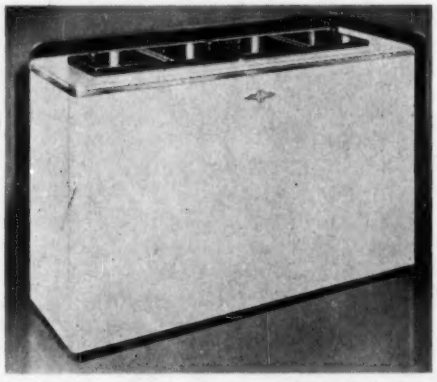
DURING these days when conservation of materials is imperative, it behooves all of us to pass on to others engaged in the common cause whatever findings we have made that will make materials and supplies go farther. The writer does not intend to imply that a serious shortage of the particular raw materials used in the manufacture of the compounds discussed in this article exists, but rather believes that waste should be eliminated whenever possible; especially, if by eliminating waste of materials, production is increased, working conditions bettered, and man-hours extended.

The evaluation of data gathered during the last few weeks in our plant has proved conclusively that the proper conditioning of greaseless abrasive compounds, which are so widely used in the metal finishing industry, is a problem worthy of much consideration at this time. In this article the writer will endeavor to give a brief history of our experience with this type of compound.

For years these compounds were stored in an ordinary ice refrigerator for the purpose of keeping them a few degrees below room temperature and also to prevent excessive evaporation of volatile constituents and subsequent hardening of the compound. This treatment was generally accepted by the polishing room as being sufficient to facilitate the use of these compounds. However, in hot, humid weather considerable difficulty was always experienced by the operators in making their compound adhere to the buff, elapsed time between charging operation and starting work was long due to slow hardening on the buff, and waste was abnormally high.

The first attempt at conditioning these compounds before using was made about two years ago, when most of such materials was being used in finishing metal compacts, which was done by chilling one end of the tube by inserting it into one of the individual holders containing dry ice as refrigerant kept at the bench. Favorable results were obtained, but the difficulty experienced in obtaining dry ice in our locality at that time and the need for dealing with more pressing problems were instrumental in causing the experimentation to be dropped at that time.

It remained for large scale production of small gun parts and the need for accurate and rapid methods of deburring to again bring this problem to the forefront. Much larger quantities of these compounds were now being used and on harder buffs, which were more difficult to charge. Caking of wasted compound in the suction ducts became more of a nuisance, especially because of the necessity for recovering precious metals from parts of the same system.



Type of refrigerator used for conditioning greaseless compounds. ***(Courtesy Frigidaire Division, General Motors Corp.)***

At this time, however, we were fortunate in having rather large quantities of dry ice on hand for the stratosphere testing of diaphragms. Recalling earlier experiments, enough compound to supply the polishing department for about five hours was stored overnight in the dry ice cabinet at a temperature of about —20° F. At this temperature the compound became extremely hard, and the first impression was that it might be difficult to apply to a buff. However, the results were most gratifying in that it took to the buff as if by magic, no doubt due to frictional heat softening the compound in contact with the buff just enough to promote adhesion. The operators' approval of the product so conditioned was unanimous, so it remained only to obtain the most convenient and economical means of refrigeration to do the job at hand.

The polishing department foreman having been conscious of the waste for some time, estimated that one-third of every cake of compound was lost in charging. After having been supplied for a few days with the material conditioned at —20° F., he estimated that only one-tenth was being sacrificed in charging. This would have meant a saving in materials of 26%, which was very conservative as will be shown by figures to be presented later.

A few simple calculations were enough to show that electrical refrigerating equipment could be amortized very quickly, not to mention the many advantages of the improved product. Manufacturers of sub-zero refrigerating units were contacted and a cabinet was purchased, which was capable of chilling a day's supply from room temperature to —20° F. in approximately fourteen hours.

As an aid in choosing suitable equipment, the following facts should prove helpful. For example, let us assume that 100 pounds of compound are to be chilled from a room temperature of 80° F. to —20° F. We have estimated the specific heat of this type of compound to be 0.50. Then, by applying the equation

$$H = W \times S \times (T_1 — T_2)$$

where H is the heat in B. t. u., W the weight of compound in pounds, S is the specific heat of the compound and T_1 and T_2 are the initial and final temperatures, respectively, we have

$$H = 100 \times 0.5 \times (80 — (—20))$$

5000 B. t. u.

Therefore, if 500 pounds of greaseless abrasive compounds are required per day to supply a group of operators, a unit capable of removing 25,000 B. t. u. in 12 hours and having adequate volume in the chilling compartments to accommodate this weight of compound should be specified. Such capacity for heat removal is necessary unless some ingenious feature is incorporated in the cabinet whereby the user would replace each chilled tube of compound removed with a warm one. Then the unit would only have to remove 25,000 B. t. u. in 24 hours. However, in the absence of such a feature it is obvious that the completely chilled compound must be distinctly separated from the warm or partially chilled tubes.

In order to illustrate more clearly the saving of material the following table is offered, in which the month of June is compared to the month of August. June represents a normal month under the old conditions and August a month in which fully conditioned compound was used throughout.

Month	*Weight of Abrasive Used per* 1000 *Pieces*	*Cost of Abrasive per* 1000 *Pieces*
June	5.08 pounds	$0.89
August	3.21 "	0.56

These figures show that the consumption of these materials has been reduced 37%.

Summary

1. Conditioning of greaseless abrasive compounds at —20° F. has effected a saving of 37% on these materials. By conditioning is meant storing the compounds in a —20° F. atmosphere until they have attained this temperature throughout. Such a saving in materials undoubtedly means extended man-hours in the plants where they are manufactured, since each unit weight that they produce will ultimately finish more pieces when properly conditioned.

2. It cannot be stated at this time that the —20° F. temperature is the ideal one for all uses of these compounds, because the abrasive so treated in our plant was so readily accepted that we did not deem further experimentation advisable or necessary.

3. Working conditions are cleaner and production has been accelerated, which means extended man-hours in our plant.

4. Refrigerating equipment having heat removal capacity of approximately 500 B. t. u. per hour for each 100 pounds of compound used per day is required. Our experience has shown that such equipment can be amortized in less than three months, provided production warrants its continuous use at near capacity level.

5. Dry ice refrigeration would accomplish the same saving of material, but could not compare to electrical refrigeration in economy or convenience.

6. We have not had the opportunity to date to try the improved abrasive compounds on decorative finishes, but have every reason to believe that they will prove successful for this work.

IDENTIFICATION OF RUST ON IRON AND STEEL

By Ralph O. Clark

Gulf Research and Development Co., Pittsburgh, Pa.

IN SOME investigations in this laboratory it was necessary to identify rust on lubricated ferrous alloys. Visual inspection could not be relied upon because of the similarity in appearance between rust and petroleum gum. Ordinary chemical tests were not applicable, since most of them brought about the removal of some of the base metal along with the rust. Removal of the rust by pressing solvent-impregnated filter or gelatin paper onto the specimen proved unsatisfactory; with all the solvents tried, the base metal was preferentially dissolved. While these tests were unsatisfactory on the whole, those obtained with gelatin paper were much better than those in which ordinary filter paper was used. This suggested the use of gelatin paper moistened with water rather than a rust solvent. Subsequently it was found that gelatin paper moistened only with water was capable of removing an amount of iron rust sufficient for testing, without affecting the metal itself.

Procedure

The gelatin paper was prepared by fixing unexposed glossy photographic paper in sodium thiosulfate solution (200 grams in 1 liter of solution), treating in a hypo-eliminating solution (1) and drying. The hypo-elminator (Kodak Formula HE-1) is prepared as follows:

Water	500 ml.
Hydrogen peroxide, 3%	125 ml.
Ammonium hydroxide, 3%	100 ml.
Water to make	1 liter

After fixing, the paper is washed 30 minutes in running water, immersed for 6 minutes in the above solution, washed for 10 minutes in water, and dried. About 6450 sq. cm. (1000 sq. inches) of paper may be processed in 1 liter of solution. Paper processed in this fashion may be stored in stoppered bottles indefinitely.

To carry out a test the gelatin surface of the dry paper is moistened slightly with distilled water and pressed firmly against the specimen. Continuous pressure on the paper is unnecessary, owing to the inherent adhesive property of the moist gelatin. After 15 to 30 seconds the paper is removed, care being taken to avoid stripping the gelatin coating from the paper base. Should it be impossible to remove the paper without this happening, the back should be moistened with distilled water and allowed to stand for a minute or so, before another attempt at removal is made.

After removal from the specimen, the test paper is immersed in 10 per cent hydrochloric acid containing 0.05 per cent potassium ferrocyanide. Upon development a Prussian blue pattern of the rusted surface is obtained. The development time should be relatively short (10 to 15 seconds) in the case of freshly rusted surfaces if an accurate rust pattern is desired. With aged or worn rust it may be necessary to extend the time of development to one minute or more. The pattern is usually more distinct if the paper is dried with heat.

The Prussian blue developed in the gelatin has little tendency to diffuse and, contrary to filter paper prints, clear, sharp patterns result. Potassium ferrocyanide is preferred to potassium thiocyanate as a developing agent since the latter tends to give a blurred and indistinct image.

(*Concluded on page* 41)

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Suggestions for Selection of Buffing and Polishing Wheels

By GERALD A. LUX

*Divine Brothers Company, Utica, N. Y.**

IT would be presumptive to intimate that this article is intended to inform and aid old time "shiners." The writer wishes to take this opportunity to express his admiration of their manual skill and ability to evaluate and classify their observations correctly. This exposition is intended to assist the engineer, superintendent or purchasing agent to understand the reasons for his finishing foreman's requisitions and suggestions.

To limit the scope of this article, assumption is made that wheels are required for metal-finishing operations, definitely within the field of flexible wheel polishing or buffing. For further simplification, it is assumed that the foresighted reader has purchased the proper model lathe with ample power and correct speed or with convenient arrangements for varying its speed.

Definitions of Polishing and Buffing

The first problem is to determine whether polishing, buffing or both are required to produce the specified surface finish on the article. Definition of these terms is essential for intelligent consideration. The A. I. E. E. "American Standard Definitions of Electrical Terms" define these operations as follows:

> "*Polishing* is the smoothing of a metal surface by means of abrasive particles attached by adhesive to the surface of wheels or belts."
>
> "*Buffing* is the smoothing of a metal surface by means of flexible wheels, to the surface of which fine abrasive particles are applied, usually in the form of a plastic composition or paste. Coloring is a light buffing of metal surfaces, for the purpose of producing a high luster."

The experienced, practical polisher or buffer may not be able to define these terms exactly or to explain his reasoning, but he can tell with a glance at an object and a sample of the finish desired on it, whether polishing, buffing or both are required and how to produce the specified finish economically. If he is not positive, he will check his opinion by actual trials on a lathe and report his recommendations promptly.

Several factors enter into the decision of whether a polishing or buffing operation is required to finish an article. Obviously, the deeper the scratches or imperfections are, the greater the amount of metal that must be removed to produce a smooth surface. Essentially, polishing and buffing are metal-removing operations. They remove a thickness of metal in excess of the deepest scratch or depression and thus produce a smooth surface. Buffing is generally limited by economic considerations to operations requiring a maximum removal of 0.0003″ of metal. The majority of buffing operations remove less than 0.0001″ of metal. Polishing is generally a heavier metal-removing operation. Commercially, the average polishing operation removes about 0.0002″ of metal, but grease polishing operations with fine abrasive may remove no more metal than buffing. With coarse abrasives, polishing operations may compare with solid grinding wheels in amount of metal removed.

Limitations and Scope of Polishing and Buffing

The characteristics of the metal to be finished comprise an important factor in deciding whether a buffing or a polishing operation is necessary to remove scratches of a given depth. In a soft metal, such as brass, die cast metal or white metal, buffing may be satisfactory. The same scratches in a steel might be impossible to remove economically by buffing.

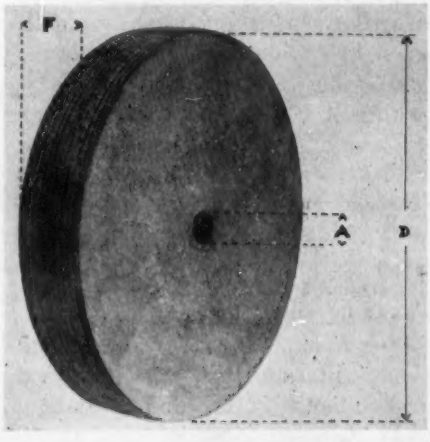

Fig. 1. Wheel dimensions: A—arbor hole; D—diameter; F—face.

A polishing or buffing operation may eliminate large scratches or imperfections, but in so doing, smaller scratches are produced. One or more successive operations may be required, using progressively finer abrasives to remove scratches produced by the preceding abrasive. Each abrasive grain acts as a metal-cutting toool. The thousands of abrasive particles on the face of a rotating wheel, in contact with an object being polished or buffed, combine their cutting action to remove a uniform depth of metal. Unless the abrasive particle size is quite fine, the gouges produced by each particle are visible and a non-reflective surface is produced. For this reason, several operations may be required to bring a casting or forging to a mirror finish. The steps from coarse to fine polishing operations are loosely designated as "roughing out," "fining," "oiling or greasing out" and "coloring." Buffing is divided into "cutting down" and "coloring" operations.

Only a relatively small percentage of soft base metals is polished; buffing generally suffices to produce satisfactory finishes. Steels usually require polishing and subsequent buffing for fine finishes; but cold-drawn stock carefully handled during fabrication may be finished satisfactorily by buffing alone. Several classes of articles such as hardware and farm tools, are finished by polishing without subsequent buffing. In normal times, a large volume of dull, electroplated coatings used for decoration and corrosion resistance, rely on buffing to impart a high luster.

Importance of Wheel Dimension and Shape

Assume that a decision has been made to obtain a polishing or buffing wheel to perform a certain finishing operation. In the desire to obtain the correct type of wheel, its physical dimensions are frequently overlooked. A buffing or polishing wheel has three

* Now with Oakite Products, Inc., New York, N. Y.

important dimensions—the diameter, face width and arbor hole diameter (see Figure 1). The size and shape of the articles to be polished or buffed as well as the lathe on which the wheel is to be used are the deciding factors in specification of these dimensions.

The diameter and type of the lathe spindle on which the wheel will run are important considerations and must be supplied to the wheel manufacturer. The correct size arbor hole permits easy placement and removal of a wheel on its lathe spindle. Too large an arbor hole allows the wheel to move on the spindle, with consequent uneven running. In manufacture, the face or periphery of a wheel is made concentric with the arbor hole. Customers' attempts to rebore or enlarge an arbor hole generally result in the new arbor hole not being concentric with the face. Retrimming the face and balancing become necessary to provide a smooth running wheel. Knowledge of the lathe spindle diameter enables the manufacturer to advise a customer against using too heavy or large a wheel on a small lathe and damaging the spindle or overloading its motor.

The peripheral speed of a rotating wheel is a measure of the linear distance traveled per unit time by a point on its circumference. It is usually expressed in surface feet per minute and is determined by multiplying the revolutions made per minute by the circumference of the wheel in feet (diameter x 3.1416). It measures the effective length of abrasive surface acting on the area exposed to the wheel per unit time. As a general rule a peripheral speed of approximately 7,500 surface feet per minute is used for the average polishing operation and one of approximately 9,700 surface feet per minute is used for the average buffing operation. These values are not universally applicable, but serve as a guide for initiating a new finishing operation. A few trials at speeds above or below will indicate the correct direction for optimum conditions.

Reference to Table I shows the peripheral speeds obtainable with wheels of various diameters used on a constant speed lathe. It also indicates the peripheral speed range of a given diameter wheel used on a variable speed lathe. The importance of correct specification of diameter wheels for constant speed lathes is obvious. Too small a wheel can materially increase the time required to produce a specified finish on an article. This is noticeable as wheels wear down through continued use. It has been shown that use of wheels reduced in diameter by long service becomes economically unsound due to increased labor required per piece of work finished. Removal of the worn wheels to a higher speed lathe or use of a variable speed lathe is a partial solution to this problem. However, higher speeds cannot offset the loss of effective contact area that larger diameter wheels possess.

The correct face width of a wheel is essential to satisfactory and efficient finishing. Too narrow a face increases the labor required by both decreasing the effective working area of the wheel and producing additional laps that have to be removed by extra labor. The increased burden on a narrow-faced wheel causes more rapid wear

(*Concluded on page 41*)

TABLE I. COMPARISON OF WHEEL SPEEDS—REVOLUTIONS PER MINUTE *vs.* SURFACE SPEED

R. P. M. at Arbor or Spindle	DIAMETERS OF WHEELS IN INCHES											R. P. M. at Arbor or Spindle
	4	6	8	10	12	14	16	18	20	22	24	
	SURFACE SPEED IN FEET PER MINUTE											
800	837	1256	1675	2094	2513	2932	3351	3770	4189	4608	5026	800
900	942	1413	1885	2356	2827	3298	3770	4241	4712	5184	5655	900
1000	1047	1570	2094	2618	3141	3665	4189	4712	5236	5760	6283	1000
1100	1152	1727	2304	2880	3455	4031	4608	5183	5760	6336	6911	1100
1200	1256	1884	2513	3142	3769	4398	5027	5655	6283	6912	**7540**	1200
1300	1361	2042	2723	3404	4084	4764	5446	6126	6807	**7488**	8168	1300
1400	1466	2199	2932	3666	4398	5131	5865	6597	**7330**	8064	8796	1400
1500	1571	2356	3142	3927	4712	5497	6284	7069	7854	8640	**9425**	1500
1600	1675	2513	3351	4189	5026	5864	6703	**7540**	8378	9216	10053	1600
1700	1780	2670	3560	4451	5340	6230	7121	8011	8901	**9792**	10681	1700
1800	1885	2827	3770	4713	5654	6597	**7540**	8482	9425	10368	11310	1800
1900	1989	2984	3979	4975	5969	6963	7959	8954	**9948**	10944	11938	1900
2000	2094	3141	4189	5236	6283	**7330**	8378	9425	10472	11520	12566	2000
2100	2199	3298	4398	5498	6597	7696	8797	**9896**	10996	12096	13194	2100
2200	2304	3455	4608	5760	6911	8063	9215	10367	11519	12672	13822	2200
2300	2408	3612	4817	6022	7225	8429	**9634**	10839	12043	13248	14451	2300
2400	2513	3770	5027	6284	**7540**	8796	10053	11310	12566	13824	15079	2400
2500	2618	3927	5236	6545	7854	9162	10471	11781	13090	14400	15708	2500
2600	2722	4084	5445	6807	8168	9529	10890	12253	13613	14976	16336	2600
2700	2827	4241	5655	7069	8482	**9895**	11309	12724	14136	15552	16964	2700
2800	2932	4398	5864	7331	8796	10262	11728	13196	14660	16128	17592	2800
2900	3037	4555	6074	**7592**	9110	10629	12147	13667	15184	16704	18221	2900
3000	3141	4712	6283	7854	**9425**	10996	12566	14137	15708	17280	18850	3000
3200	3351	5026	6702	8378	10053	11729	13404	15079	16755	18431	20107	3200
3400	3560	5340	7121	8901	10681	12462	14242	16022	17802	19583	21363	3400
3600	3769	5654	**7539**	9425	11309	13193	15079	16964	18850	20735	22619	3600
3800	3979	5969	7958	**9948**	11938	13927	15917	17907	19897	21887	23876	3800
4000	4188	6283	8377	10472	12566	14661	16755	18850	20944	23039	25132	4000

NOTE: Where two bold figures appear in a vertical column, the lower speed is suitable for polishing; the higher for buffing. For speeds abnormally higher than bold figures, consult the manufacturer of the wheel.

An Electroplating Library—Revised and Amplified

Compiled by GEORGE B. HOGABOOM, SR.

The inestimable value of a good reference library is well known to research workers. Not only is the reliability of a statement increased by the inclusion of a reference, but the prestige of the author is established by such evidence of his thoroughness in investigation and broadmindedness of attitude toward other investigators.

Publication of the original list of books on the electrodeposition of metals in the July, 1943 issue of METAL FINISHING resulted in a gratifying number of responses advising of books which had not been included. For a goodly number of the volumes listed below in this revised library—especially those in foreign languages—we are indebted to the courtesy of Dr. F. R. Morral of the Mellon Institute of Industrial Research.

To complete the list of reference sources on the electrodeposition of metals, it was considered desirable to include English language periodicals which may be consulted for information on the subject. These are listed following the revised bibliography and, unless otherwise noted, are still in publication.

1851 Elements of Metallurgy—*By A. Smee*

1853 A Manual of Electro Metallurgy—*By J. Napier*

1872 Practical Guide for the Gold and Silver Plater and the Galvanoplastic Operator—*By A. Roseleur* (Translated by A. A. *Fesquet*)

1876 Electro Metallurgy (6th Edition)—*By A. Watt*

1883 A Practical Guide for the Gold and Silver Plater and the Galvanoplastic Operator—*By W. H. Wahl*

1886 Electro Deposition—*By A. Watt*

1891 A Practical Hand-Book of Electroplating—*By E. Trevert*
The Electroplaters' Handbook (1st Edition)—*By G. E. Bonney*

1894 The Practical Electroplater—*By M. Brunor*

1897 Modern Electroplating—*By J. H. Van Horne*

1898 Electro-Deposition of Metals (3rd Edition)—*By Dr. G. Langbein and W. T. Brannt*

1904 Electro Metallurgy (15th Edition)—*By A. Watt*
Polishing and Plating of Metals—*By H. J. Hawkins*

1905 Electro-Deposition of Metals (5th Edition)—*By Dr. G. Langbein and W. T. Brannt*
Electroplaters' Handbook—*By J. H. Weston*
Electro Plating—*By J. W. Urquhart*
Up-To-Date Electroplating—*By J. H. Weston*

1906 Manufacture of Metallic Objects—Electrolytically—Electro-Engraving—*By Dr. W. Pfanhauser* (Translated by J. W. W. Richards)

1907 Metal Coloring and Bronzing (2nd Edition)—*By A. H. Hiorns*

1908 Decoration of Metal, Wood, Glass, Etc.—*By H. C. Standage*
Electro-Metallurgy—*By J. B. C. Kershaw*
Electroplating—*By W. E. Hughes*
Practical Electroplating—*By W. L. D. Bedell*

1909 Electro-Deposition of Metals (6th Edition)—*By Dr. G. Langbein and W. T. Brannt*
Electroplating—*By P. N. Hasluck*

1910 A Treatise on Electro Metallurgy (3rd Edition)—*By W. G. McMillan* (Revised by W. R. Cooper)
Modern Electroplating—*By J. H. Van Horne*

1911 Electroplating—*By H. J. Reetz*
Principles of Electro Deposition—*By S. Field*

1912 Dipping, Burnishing, Lacquering and Bronzing Brass Ware—*By W. N. Brown*
Electro Plating—*By W. R. Barclay and C. H. Hainsworth*

1913 Electro-Deposition of Metals (7th Edition)—*By Dr. G. Langbein and W. T. Brannt*
Electro Plating and Analysis of Solutions—*By H. H. Reama*

1916 Decorative Glass Processes—*By A. L. Duthie*

1917 The Cleaning and Electroplating of Metals—*By H. H. Reama*

1920 The Modern Electroplater—*By K. M. Coggeshall*
Electro-Deposition of Metals (8th Edition)—*By Dr. G. Langbein and W. T. Brannt*
Electroplating, A Practical Handbook On The Deposition of Copper, Silver, Nickel, Gold, Brass, Aluminum, Platinum, etc. (6th Edition)—*By J. W. Urquhart*
Electroplating—*By A. Watt*

1921 Symposium on Electrodeposition and Electroplating—*Transactions, Faraday Society*

1922 Galvanizing and Tinning (2nd Edition)—*By W. T. Flanders*

1923 Practical Electroplating (5th Edition)—*By W. L. D. Bedell*
Modern Electro Plating—*by W. E. Hughes*

1924 Cadmium, Its Metallurgy, Properties and Uses—*By N. F. Budgen*
Electro-Deposition of Metals (9th Edition)—*By Dr. G. Langbein and W. T. Brannt*

1925 Principles of Electroplating and Electroforming—*By W. Blum and G. B. Hogaboom*
The Chemical Coloring of Metals and Allied Processes—*By S. Field and S. R. Bonney*

1926 Galvanizing—*By H. Bablik* (Translated by Charles T. C. Salter)

1928 Protective Metallic Coatings—*By H. S. Rawdon*
Study of Chromium Plating—*By R. Schneidewind*

1930 Electroplating—*By Field and Weill*
Electroplating with Chromium, Copper and Nickel—*By F. Freeman and F. G. Hoppe*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
Principles of Electroplating and Electroforming (2nd Edition)—*By W. Blum and G. B. Hogaboom*

1931 Plating and Finishing Guidebook—*Metal Industry Publishing Co.*

1932 Chromium Plating (1st Edition)—*By E. S. Richards*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
Protective Films on Metals (1st Edition)—*By E. S. Hedges*

1934 Practical Handbook on Electroplating (12th Edition)—*W. Canning Co.*

1935 Chromium Plating—*By O. Bauer, H. Arndt and W. Krause* (Translated by E. W. Parker)
Electroplating—*By J. V. Alfriend, Jr.*
Electroplating—*By Field and Weill*
Finishing Metal Products—*By H. R. Simonds*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
The Metal Cleaning Handbook—*By Robert W. Mitchell*
The Structure of Metallic Coatings, Films and Surfaces—*The Faraday Society*

1936 Chromium Plating—*By E. S. Richards*
Electroplating—*Popular Science*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*

1937 Metallic Corrosion, Passivity and Protection—*By N. R. Evans*
Protective Films on Metals (2nd Edition)—*By E. S. Hedges*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
Practical Handbook on Electroplating (13th Edition)—*W. Canning Co.*

1938 Metal Colouring and Finishing (2nd Edition)—*By H. Krause*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
Electroplating—A Survey of Modern Practice—*By S. Field and A. D. Weill*

1939 Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
Protective Coating for Metals—*By R. M. Burns and A. E. Schuh*

1940 Anodic Oxidation of Aluminum and Its Alloys—*By Dr. A. Jenny* (Translated by Winifred Lewis)
Bibliography; Coatings for Corrosion Protection Including Allied Researches—*Standard Steel Spring Division, Research Laboratory, American Documentative Institute.*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*
Practical Handbook on Electroplating (14th Edition)—*W. Canning Co.*
Silver in Industry—*By L. Addicks*
The Platers' Handbook—*R. Cruickshank, Ltd.*

1941 Electroplating and Anodizing, etc.—*By J. Rosslyn*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*

1942 Modern Electroplating—*The Electrochemical Society*
Plating and Finishing Guidebook—*Metal Industry Publishing Co.*

1943 Chromium Plating, Bibliography and Correlated Abstract of the Published Literature—*By M. Kolodney*
Electroplating: A Survey of Modern Practice Including the Analysis of Solutions (4th Edition)—*By S. Field and A. D. Weill*

Foreign Language

1855 Doreur de L'Argenteur et du Galvanoplaste—*By A. Roseleur*

1899 Handbuch der Galvanostegie und Galvanoplastik—*By H. Stockmier*

1892 Dedicace de la Premier Edition Hydro-Metalloplastic de la Deuxieme Edition—*By A. Roseleur*

1904 Die Galvanoplastik—*By Dr. W. Pfanhauser*

1910 Uber Elektrolytische Metallniederschlaege—*By M. Schloetter*

1911 Ueber Besondere Einrichtungen zum plattieren—*By M. Schloetter*
Die Galvanischen Metallniederschlage—*By H. Steinach and G. A. Buchner*

1914 Galvanizzazione (3rd Edition)—*By Di Frederic Werth*

1922 Metallfarbung—*By H. Krause*

1923 Galvanotechnik, Galvanostegie und Galvanoplastik—*By H. Krause*
Die Galvanishen Metallneiderschlage und deren Ausfuhrung—*By H. Steindach and G. A. Buchner*

1924 Prinzipien der Galvanotechnik—*By J. Billiter*
Manuel Practique de Dorure, Argenture, Nickelage, Etc.—*By J. Ghersi and P. Conter*

1926 Das Verchromung—Verfahren—*By Dr. W. Pfanhauser*

1927 Depots Metalliques Directs et Indirects—*By M. Gasnier*

1928 Die Electrolytischen Metallniederschlaege—*By Dr. W. Pfanhauser*

1929 Metallniederschlaege und Metallfarbungen—*By F. Michel*

1930 Die Herstellung von Metallgegenstaenden auf Electrolytischen Wege und die Elektrogravuere—*By Dr. W. Pfanhauser*

1931 Galvanotechnik, Galvanostegie und Galvanoplastic.—*By H. Krause*
Nickel Plating (Japanese and English)—*By J. Macdonald Smith*

1932 Chromatura Elettrolitica—*By O. Macchia*

1933 Simple Treatise on Nickel and Other Plating (2nd Edition) (Japanese and English)—*By J. Macdonald Smith*

1934 Prinzipien der Galvanotechnik—*By J. Billiten*

1935 Protection des Metaux Contre la Corrosion—*By A. Guerillot*
Traite de Galvanoplastic—*By J. Salauze*
Die Praxis der Verchromung—*By W. Birrett*

1936 Galvanotechnik (7th Edition)—*By H. Krause*

1937 Galvanotechnik—*By H. Krause*
Metallfarbung—*By H. Krause*

1941 Die Hartverchromung—*By O. Kramer*
Galvanotechnik (10th Edition)—*By H. Krause*
Metallische Uberzuge—*By W. Machu*
Galvanotechnik (2nd Vol.)—*By Dr. W. Pfanhauser*
Die Galvanotechnik (5th Edition)—*By A. Wogrinz and G. Buchner*

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Brass World (Discontinued 1933)
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Inco (International Nickel Company)
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Metal Cleaning and Finishing (Discontinued 1938)
Metal Finishing
Metal Industry (London)
Metal Record and Electroplater (Discontinued 1918)
Metals and Alloys
National Electroplaters' Association "Bulletin" (Discontinued 1914)
Platers' Guide (Discontinued 1936)
Proceedings, American Electroplaters' Society
Products Finishing
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Transactions, The Electrochemical Society
Transactions, The Faraday Society
The Nickel Bulletin (Mond Nickel Co., London)
The Iron Age
The Monthly Review (Quarterly Review), American Electroplaters' Society
The Tin Research Institute and International Tin Research and Development Council (Several publications)
The Plate (Discontinued 1909)

Deburring Metal Parts in Bulk

By ROBERT SIZELOVE

Technical Director, Frederick Gumm Chemical Co., Inc., Kearny, N. J.

PRIOR to the present emergency, deburring of metal products was confined to the removal of casting fins from zinc, brass and iron castings, and several lesser applications; like the removal of extrusion burrs from stamped objects, and tool burrs from brass screw machine products.

For years, iron and brass casting burrs have been partially removed by rumbling in sand in the casting room. Usually the burr removal was not complete as hard wheel operations and burring operations were subsequently required prior to plating for bright finish. Barrel deburring of fins on zinc base die castings was being experimented with just prior to the present emergency, and several companies had small production tumbling set-ups for definning and bright finishing small parts.

For many years there has been a limited application for deburring stamped brass, bronze, copper, and steel metal products, but usually these parts were made from thin metal and very little burr was present. In fact, there was generally no burr present and only a sharp edge had to be smoothened down—which was accomplished by burnishing with steel balls and burnishing soap. In the past, most brass screw machine products were just centrifuged for oil and chip removal and were then cleaned and bright dipped prior to assembly. The bright dip removed the tool burrs.

Since July 1941 the type of goods manufactured for war production has introduced a number of new deburring problems. The type of burrs which we now encounter include sawing burrs, milling burrs, drilling burrs, extrusion burrs, casting-fin burrs, and screw machine products tool burrs.

During the year 1943 many billions of brass screw machine products were tumble deburred for use in fuze mechanisms. Ninety per cent of these parts are very small, no larger than ½ cubic inch in volume. They have edge tool burrs from the screw machine operation and also milling and drilling burrs. In pre-war days these burrs were removed by bright dipping, but on ordnance work this is taboo. During the late part of 1941 and early 1942 many plants had operators deburring these parts by hand with a file, sanding belt or with a roughened tool. If the entire 1943 production were hand deburred it would require over 100 million man-hours of labor. Fortunately

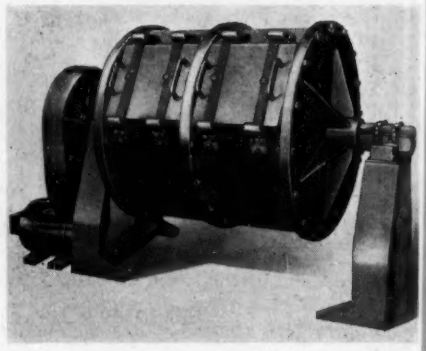


Fig. 2. Horizontal barrel with two compartments.

the introduction of tumble deburring methods has eliminated this. In comparison the 1943 production will require about 1 million man-hours using tumble deburring. This is a 99% saving in man-hours with about a 75% saving in labor cost. About 10% of the total production of screw machine parts are either too large or have too delicate external threads for tumble deburring. These parts are deburred using a greaseless compound on a muslin buff or by using a tampico brush with emery cake.

Tumble deburring has also been a life-saver for plants producing pistols, rifles, carbines, automatic-rifles, submachine guns, anti-aircraft guns and bazookas.

Other typical examples of the application of tumble deburring are aluminum aircraft parts, aluminum fuze parts, steel fuze parts, and steel engine parts. Some of the parts are too large to be allowed to tumble freely so they are racked in the tumbling barrel.

There are five principal tumble deburring methods being used in production at present.

The first method involves the use of sand and water. The process has been used for many years. Sand is mixed with work in a ratio of about 2:1 by volume and water is added, sometimes partially and sometimes completely covering the mass. The sand acts as a cushioning medium as well as the deburring medium. This process has the disadvantages that the deburring is slow, requiring thirty to sixty hours on heavy burrs, and also that the metal is often badly pitted during the deburring operation. The sand and water

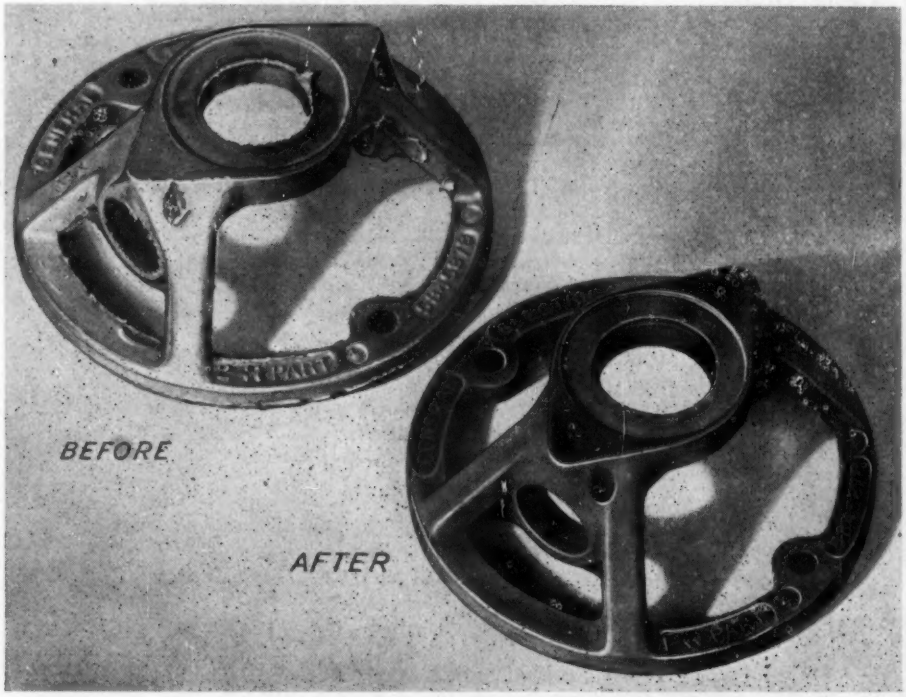


Fig. 1. Zinc base die castings.

process is used in either a narrow vertical barrel, a thin horizontal barrel or an oblique barrel.

The second method uses oil and abrasive. This method was developed by several industrial plants and its use has spread to many other plants. This process is being employed in various ways. Sometimes straight mineral oil is used and sometimes soluble oil. The type of abrasive varies widely, including fine sand, coarse sand, emery, artificial aluminum oxide, boron oxide or silicon carbide. Oblique, horizontal and vertical barrels are used. If the parts are not self-tumbling, a medium must be added to cushion the work. The oil is mixed with the abrasive to a thick paste and poured on the deburring mass. The deburring time on small burrs varies from 2 to 10 hours. This process is not applicable where the burrs are large as the burr is peened over against the work before it is removed. It is, however, very applicable for radius finishing after the burr has been removed. Incidentally, the oil and abrasive mixture is often removed with difficulty from the parts after deburring, which may necessitate the use of a spray type washing machine.

The third method is dry tumble deburring. This method has been in vogue for years, using mixtures of work, fine abrasives and a medium like leather scrap or nut chips. Essentially there must be a cushioning medium present like leather, which also acts as a carrying medium to carry the abrasive to the burr. The grain size of the abrasive can be so regulated that a semi-luster is obtained after deburring. However, when this is done, the deburring time is usually very high,

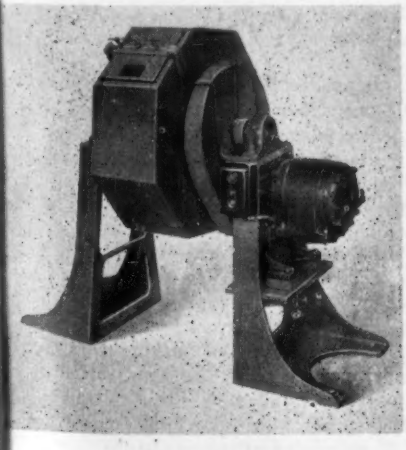


Fig. 3. Vertical barrel.

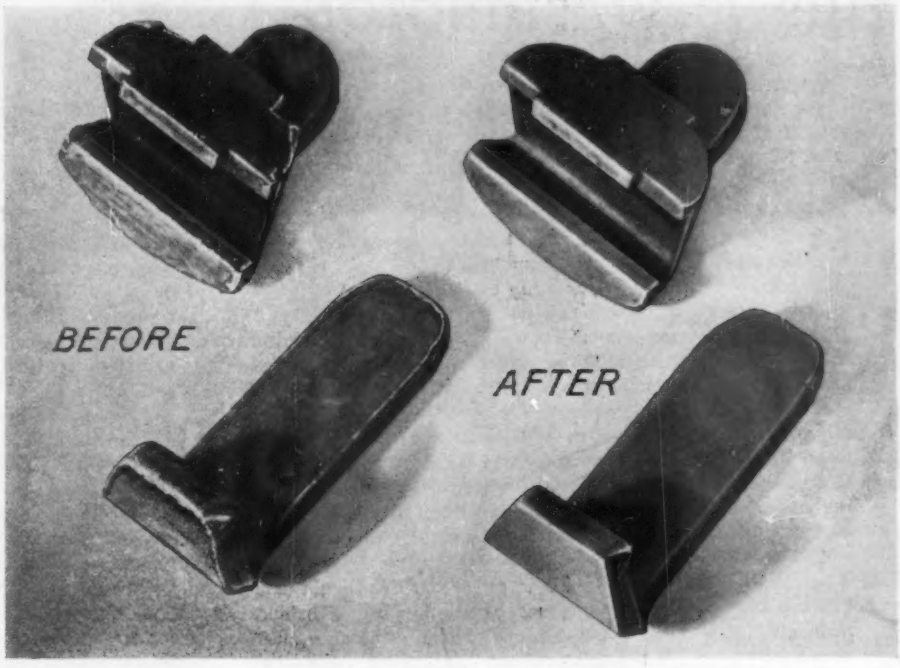


Fig. 4. Steel gun parts.

from 40 to 60 hours. It is sometimes better to use two operations when a high finish is desired, the first being the deburring operation with a coarse abrasive and then a finishing operation with crocus, rouge or levigated alumina. With two operations the time can usually be cut in half.

The fourth method consists essentially of using a non-metallic cushioning and deburring medium plus a deburring powder and water. The medium which cushions and deburrs usually consists of either granite or quartz lumps. The deburring solution helps to deburr and also keeps the deburring medium from going smooth during the deburring operation. This process can be used in either a horizontal, vertical or oblique barrel. The ratio of work to deburring medium will vary from 1:3 to 3:1 depending on the size and shape of work being deburred. The amount of water and deburring powder to use is dependent also on the type of work being finished. The deburring time varies from 1 to 10 hours depending on the severity of the burr.

The fifth process consists essentially of using a metallic cushioning and deburring medium plus a deburring solution. The metallic medium is so selected that magnetic separation can be used to separate the work and deburring medium after the operation is completed. The ratio of work to deburring medium varies from 3:1 to 1:3 depending on the size and shape of the work being tumbled. The type of work also determines the amount of deburring solution to use. The deburring time varies from 1 to 6 hours depending on the type and severity of burr to be removed. Either an oblique, horizontal or vertical barrel can be employed. Often it is advantageous to use an automatic separating tumbler which accomplishes medium and work separation by reversal of the direction of rotation.

It is the writer's experience that each deburring job has to be individually engineered to determine the type and speed of barrel, the type of deburring medium, ratio of deburring medium to work, type and amount of deburring solution and amount of water. These factors are very important in obtaining minimum deburring time and minimum operational cost. Also, these factors determine the type of surface finish obtained. Many specifications require a surface finish after deburring as fine as 3 micro inches (0.000003"). Therefore, it is practically impossible in this short article to make detailed recommendations for any one job. However, manufacturers of deburring equipment and materials will be very glad to make specific recommendations on any sample parts sent to them. Also, as we have said above, there are certain types of work which cannot be tumble-deburred and on these should be used a wheel operation with greaseless or similar compounds.

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Electroplating and Anodizing Equipment Restrictions Eased On December 16, 1943 the War Production Board lifted restrictions on the acquisition of electroplating and anodizing equipment to allow users to obtain needed spare or repair parts without the necessity of filling a PD-1A form as in the past. Equipment up to a value of $500 may now be acquired under the automatic ratings granted this industry under CMP Regulation 5.

Diggin on Lead Plating Myron B. Diggin presented on December 4, 1943 a paper on "Lead Plating" before the Baltimore meeting of the Baltimore-Washington Branch of the AES, which was attended by the biggest turnout of members this season.

Why Lead Plating Lags Behind In his introduction Mr. Diggin said that lead plating has lagged behind other forms of plating because most platers are unfamiliar with the methods of lead plating and because of the health hazard of this kind of plating. Then he dealt with the advantages and disadvantages of the fluosilicate bath, the fluoborate bath, and the alkaline bath. In discussing this last mentioned bath he said that a new one will soon be placed on the market. Animal glue, he warned, should be tested before using to prevent black spots. An excessive amount of glue, he added, will also produce black spots.

Outline of Lead Plating Paper In his informative paper Mr. Diggin described (1) how to prepare articles for lead plating, (2) the equipment used in lead plating, (3) the materials of construction, (4) how to protect the interior of tanks with primers and synthetic paints, (5) how to keep solutions clean, (6) the methods of acidity testing, (7) the effects of impurities in lead anodes, (8) how to remove the impurities, (9) the effect of temperature, (10) the present uses of lead plating, (11) the time required for various thicknesses of lead deposition together with the cost of lead per square foot, and (12) the results of salt spray resistance tests on lead plating.

Future of Lead Plating To reduce the health hazard Mr. Diggin discussed the importance of proper clothing, gloves, protection of platers' foodstuffs against lead poisoning, respirators, and ventilating tanks. In concluding his paper he said that lead plating is superior to cadmium plating and zinc plating as protection against weather corrosion. He also said that in the future steel wire will be lead plated, and that strip will be protected with lead alloy plating. After the presentation of his paper there was considerable discussion on scratches on lead and the self-healing powers of lead.

Abrasive Situation Eased The size of the exemption from authorization for small orders of abrasive grain was increased to 20,000 pounds in each two-month authorization period beginning January 1, 1944, by the War Production Board on December 16, 1943, through issuance of an amendment to Conservation Order M-319. The increased exemption will reduce by 60 per cent the number of applicants required to file requests for authorization and will release only four or five per cent of production from control, WPB said. Abrasive grain is any manufactured crude abrasive (silicon carbide or fused alumina) used in cutting or surface finishing operations, which has been classified as a particle size.

Not more than 4,500 pounds of the 20,000 pound exemption can be of any one grit size finer than 220. Applications already filed with WPB for the January-February 1944 period, covering total quantities of abrasive grain which are less than the new exemptions, are being returned to applicants, the Abrasive Section of the Tools Division said. All such applicants need do is to place their orders for the grain with their normal suppliers. Order M-319 previously provided a small order exemption in each authorization period of the dollar equivalent of 2,000 pounds of aluminum oxide and 2,000 pounds of silicon carbide.

Acetic Acid Restrictions Eased Suppliers are now permitted to sell 54 gallons or less of acetic acid during any calendar month without specific authorization according to Order M-243 as amended on November 20, 1943. Anyone selling more than 54 gallons a month of this chemical must obtain authorization from WPB as in the past.

Antimony Released From Allocation General Preference Order M-112 was amended on December 4, 1943 for the purpose of releasing antimony from allocation after January 1, 1944. However, quarterly reports will be required to permit the WPB to observe the antimony market conditions.

Antimony Under New Regualtion Antimony metal and the antimony compounds were removed on December 9, 1943 from the General Maximum Price Regulation to Maximum Price Regulation No. 497. The new OPA regulation established a base ceiling on 99 per cent antimony metal at 14.5 cents a pound in carload lots; and on 99.8 per cent antimony a base of 15 cents a pound in carload lots. And the maximum price for any of the 15 compounds "shall be (1) the highest price charged by the seller for the same commodity on a delivery made during March 1942 to a purchaser of the same class, or if no such delivery was made during March 1942, (2) the highest offering price for delivery during March 1942 of the same commodity to a purchaser of the same class." The new regulation also established the rules of determining prices of less than carload lot shipments.

Army Procurement Regulation No. 15 Revised It was announced on November 29, 1943 that the War Department Procurement Regulation No. 15 was revised so that when production is to be reduced by 25 per cent or more by contract terminations the Army will notify WPB so that it can aid in securing continuous employment of facilities. The revision applies to Section 15:326; 15:326.1; and 15:326.2. The revised regulation provides that the prime contractors must notify subcontractors of contract termination.

Chromium Formula for Stainless Steel Supplementary Order M-21-a, as amended, and Directive 3, issued on December 1, 1943 permits a freer use of chromium in the manufacturing of stainless steel. The amended order and directive also set up a new formula on how to calculate the proportion of chromium which may be used in making stainless steel.

CMP Regulation No. 9A Issued CMP Regulation No. 9A was issued by WPB on November 26, 1943 to loosen up controlled materials to those persons engaged in the business of making repairs. Under this regulation repairmen may buy during a calendar quarter "up to 20 tons of carbon and alloy steel, a total of 500 pounds of copper and copper base alloy brass mill and foundry products, and 200 pounds of aluminum in the forms listed in Schedule I"—and "a repairman may buy as much

other materials and repair parts as he needs for his maintenance and repair work." A preference rating of AA-2 may be used by repairmen whose work is primarily of an industrial nature and it is necessary for them to buy up to 2,000 pounds of copper wire and 2,000 pounds of copper and copper base alloy brass mill and foundry products. Repairmen who do work for persons who have the right to use an AA-2X or higher preference rating to buy non-controlled materials and parts for their own maintenance and repair work may use their customers ratings to buy what they need, or to replace their inventories used on behalf of the customers.

Copper Fabricated Parts Released The amended version of Schedule I of Order L-236 (Hardware Simplification) issued on November 30, 1943 released about 3,000,000 pounds of fabricated copper and copper base alloy parts for use in the manufacture of builders' finishing hardware, cabinet locks and padlocks. All parts, however, may be used only for items conforming to the simplified practices established by the Schedule. Permission to use parts in the manufacture of non-conforming items must be secured through the process of appeal.

Copper and Brass Restrictions General Limitation Order L-315 was issued by the WPB on September 16, 1943 to conserve copper and brass in the making of secondary electrical distribution equipment such as safety switches, knife switches, and enclosed branch and service circuit breakers. This order prohibits the use of galvanized steel for enclosures, and it bans the use of brass and copper in neutral terminal plates in devices rated at 70 amperes or less. It is estimated that the restriction will result in a saving of 100,000 pounds of copper and 450,000 pounds of zinc for more essential needs.

Copper Reserve Corporation The Copper Recovery Corporation which has acted as agent for Metal Reserves Corp. in acquiring inventories and re-selling them to ingot makers and brass mills for remelting may soon be dissolved.

Galvanizing Trend During the peace years of the period from 1899 to 1939 the average annual of materials, supplies, purchased electrical energy, and contract work per establishment engaged primarily in coating sheets and formed products with zinc (galvanizing or sherardizing), aluminum, and lead in plants not operated in connection with steel rolling mills ranged from $22,000 to $200,000 per plant per annum, and the average annual value of products per establishment fluctuated between $50,000 and $280,000. According to the census reports, from 1899 to 1939 the value of products in this category reached a peak of $14,500,000 in 1919 and a low of $2,470,703 in 1899. The index numbers for this branch of the metal finishing industry are presented here.

Index Numbers with 1927 as 100

Year	*Number of Establishments*	*Average Annual Cost of Materials, etc.*	*Average Annual Cost of Products*
1899	28	95	70
1904	36	206	139
1909	46	191	124
1914	48	206	138
1919	52	319	220
1921	51	67	62
1923	51	107	97
1925	54	86	86
1927	59	100	100
1929	65	95	93
1931	60	44	53
1933	54	35	39
1935	65	52	63
1937	64	64	73
1939	83	48	59

Galvanizers Directive The WPB announced on November 18, 1943 that galzanized steel products in controlled form are Class A products when sold by a galvanizer who is not a steel producer. Galvanizers who are not steel producers may place orders for the steel required to fill orders actually received from warehouses or to replace in inventory metal used to fill orders actually received from warehouses by using Form WPB-2444. To obtain steel to fill other orders, galvanizers must receive an allotment from their customers, and identified by the allotment symbol "WH". This and other rules governing the sale of galvanized steel products are found in Direction No. 38 to CMP Regulation No. 1.

Grade Terminology Booklet Coming In the near future the National Bureau of Standards will make available a pamphlet entitled "The Grade Terminology Problem, Miscellaneous Publication B-178". This informative pamphlet will cover the points of view of consumers, distributors, manufacturers and testing laboratories on grade classification and terminology. It will describe the grade designations of countless items. For example, it will describe the grade of Double or XX silver flatware as carrying 4 ounces of silver per gross of teaspoons; and XXX or Triple as containing 6 ounces of silver.

Inventory Interpretation on PR No. 1 Interpretation No. 8 to Priorities Regulation No. 1, issued on November 23, 1943, points out that "if one unit of a firm has exceeded its inventory limit, units that have not so exceeded their limit are not prevented from acquiring additional inventory within their own individual limits." In other words, separate operating units of a compnay are subject to WPB inventory restrictions individually.

Labor Unemployment Turnover Causes The Office of War Information revealed on November 26, 1943 that there are about twenty-six definite causes which are responsible for the heavy labor turnover in American war production plants. Some of these causes are (1) the desire to get a job with better wages, (2) the worker feels that he is not doing enough for the war effort, (3) no chance of advancement, (4) no opportunity to express his ideas, (5) ability not be recognized, (6) poor health, (7) inadequate housing facilities, (8) fed-up with traveling on crowded vehicles of transportation, (9) working hours not satisfactory, (10) working conditions not satisfactory, (11) dislike of the foreman, (12) homesickness, (13) disgusted with enforced delays, layoffs or work interruptions, (14) lack of restaurants near the plant, and (15) the special feminine reasons such as (a) desire to join her husband, (b) getting married, etc.

Lead Stockpile Declining At the November 1943 meeting of the WPB Lead Producers Industry Advisory Committee, it was the consensus of those present that the position of lead, while not critical, requires watching. Several of the Committee pointed to the steadily increasing withdrawals from stockpiles. It was also revealed that the domestic production of lead may decline in 1944 because of labor shortage. During 1943 domestic production amounted to 40 per cent of the total domestic consumption.

Loans to Small Businesses Advocated Chairman Donald M. Nelson of the WPB, in a recent communication addressed to the Senate Sub-committee on War Contract Terminations, recommended that legislation should be passed for mandatory loans to small business for reconversion purposes. He suggested that the Smaller War Plants Corporation should be empowered to make such loans. Mr. Nelson placed emphasis on the need for interim financing because economic stagnation might result from "leaving large segments of industry with their funds frozen in claims against the Government for an indefinite period."

MRO Rating Procedure Procedures governing the use of blanket MRO preference ratings in buying certain chemicals or other materials were clarified on December 8, 1943 by the issuance of Direction No. 5 to Priorities Regulation No. 3. According to this direction, the use of blanket MRO ratings of AA-1 and AA-2 are not permitted in the buying of chemicals or other materials included in the list attached to the order. The order provides that the following ratings may be used for materials contained in the list: "(1) AA-2X by persons eligible to use an AA-1 preference rating. (2) AA-3 by persons eligible to use an AA-2 preference rating. (3) Ratings for production materials to be physically incorporated in a product or construction project may be used to get the materials in the list for MRO for use in the production of that product or construction project. However, any materials so purchased must be deducted from the MRO quota under CMP Regulation No. 5 or any other regulation or order that places a quota limit in MRO purchases. (4) Any rating assigned by a preference rating certificate that specifically names the kinds and quantities of the items rated may be used."

Nickel Plating Permitted for Goggles Limitation Order L-114 as amended November 22, 1943 provides that "no person shall incorporate in the manufacture of safety equipment, or in any component part thereof, any of the following materials: aluminum, asbestos cloth, chromium, copper, copper base alloys, nickel, corrosion resisting steel, alloy steel, tin, plastics, rubber, synthetic rubber, or elastic fabric, as defined in Conservation Order M-174." This restriction does not apply to goods for the armed services, Maritime Commission, Panama Canal and a few other Government agencies. This amended order permits the use of "nickel plating for (i) spectacle type industrial goggles and slip-overs for industrial spectacles. (ii) Safety and admission valves, saliva tubes and mouthpieces for oxygen breathing apparatus; facepiece check valve bodies for inhalators; and check valves for hose masks; to the extent necessary for the efficient functioning of the named parts."

Porcelain Enameled Products The Department of Commerce reports that the value of shipments of porcelain enameled products such as signs; drain boards and tub covers; table tops; stove and refrigerator parts; reflectors; store fronts and other architectural porcelain parts; cooking, household and hospital utensils, and washing machine parts during the first eight months of 1943 totaled $19,888,714 as compared with $37,973,288 in 1942, and with $42,070,836 in 1941.

Price Regulation Collation Available As an aid to the machinery industry and its 40,000 related establishments throughout the United States, the Office of Price Administration issued on November 25, 1943 a 27-page collation of Maximum Price Regulation No. 136 (Machines and Parts and Machinery Services), together with all amendment since the issuance of the regulation. *Metal Finishing* readers should get a copy of this collation from their local OPA office because it deals with electrical equipment, *paint-making machinery*, chemical process machinery, *and electroplating and hot dip metal coating equipment, including preparatory and finishing equipment used in connection with metal coating processes.*

PR No. 7 Adopts New Form Priorities Regulation No. 7 as amended November 27, 1943 adopted this simplified form of standard certification: "The undersigned purchaser certifies, subject to the penalties of Section 35(A) of the United States Criminal Code, to the seller and to the War Production Board, that, to the best of his knowledge and belief, the undersigned is authorized under applicable War Production Board regulations or orders to place this delivery order, to receive the items (s) ordered for the purpose for which ordered, and to use any preference rating or allotment number or symbol which the undersigned has placed on this order." The regulation also specified that if this standard form of certification is used, the following information will be required: "1. A preference rating, allotment number or symbol must be added when required by an applicable order or regulation. 2. Where a regulation or order requires a specific statement of immediate end use, such statement must be added. 3. Where an applicable order calls for a statement to show that a small order exemption under any L or M order is applicable, the words 'in compliance with a small order exemption' shall be added. 4. Where the preference rating was obtained on a WPB-547 (PD-IX) certificate, the identification 'WPB-547' or 'PD-IX' must be added."

Products and Priorities Takes Over The War Production Board has withdrawn from publication "Official CMP Class B Product List and Class A Civilian Type End Product List". This information will now be found in the monthly editions of "Products and Priorities" under the heading of "Official CMP Product List".

Rubber Uses Specified Rubber Order R-1 as amended December 4, 1943 specifies the quantity of crude rubber and natural latex which may be used in the manufacturing of such metal finishing equipment as electroplating racks, electroplating automatic machine perforated steel base baskets, sand blasters, and paint sprays.

Treasury Silver Available to Industry Purchase authorizations totaling some 25,000,000 ounces of Treasury silver made available to essential industries under the Green Act have been issued by the War Production Board up to and including December 7, 1943. This was disclosed at the meeting of the WPB Silver Producers and Distribution Industry Advisory Committee who expressed satisfaction with Silver Conservation Order M-199 as amended November 10, 1943.

Unemployment Predicted William Haber, Executive Director of the War Manpower Commission, predicts that 150,000 workers will be dropped from the employment rolls of war production plants by March first. This decrease in employment will occur, he reports, in the smelting, foundry, ball bearing, radio and radar, and aircraft industries. And authoritative sources report that Secretary of Commerce Secretary Jesse H. Jones, who is chairman of the Defense Plants Corporation, is ready to sell certain plants engaged in war production.

Wage Payment and Collection Analysis The United States Department of Labor has just issued an informative pamphlet on "Wage Payment and Wage Collection Laws". Copies may be obtained from the Division of Labor Standards, Department of Labor, Washington, D. C., or from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., for ten cents. In issuing this pamphlet Secretary of Labor Frances Perkins said: "Even today, when jobs are plentiful, workers are victimized by fly-by-night employers who are financially irresponsible and cannot or do not meet their pay roll regularly. Forty-five States have passed laws protecting a worker's right to the wages he has earned, but workers often are not familiar with these laws."

Zinc Restrictions The use of zinc for the manufacturing of items not specifically prohibited on List A attached to Conservation Order M-11-b, as amended on October 1, 1943, was set at 15 per cent by weight of the amount of zinc used in the calendar year 1941. The prohibitions and restrictions of the order do not apply to the use of zinc as zinc dust for certain specified purposes, or for the manufacture of zinc oxide, as provided in Orders M-11 and M-11-1.

Dictionary of Metal Finishing Chemicals

Nickel Chloride: $NiCl_2 \cdot 6H_2O$. Mol. wt. 237.70. Yellowish green, monoclinic crystals. Very deliquescent. Solubility, 254 at 20° C. and 600 at 100° C. Soluble in alcohol, ammonium hydroxide. Grades: Technical, C. P., C. P.—low cobalt. Containers: Bottles (1, 5 lb.); Boxes, Cartons (10, 25 lb.); Kegs, Fiber Drums (50, 100 lb.); Barrels (275, 350, 400 lb.).

Nickel Cyanide: $Ni(CN)_2 \cdot 4H_2O$. Mol. wt. 182.79. Light green plates or powder. Loses water of crystallization at 200° C. Decomposes when heated further. Insoluble in water. Soluble in cyanide solutions, ammonium hydroxide, alkalis. Grades: Technical, Purified. Containers: Tins (1, 5, 25 lb.); Drums (100 lb.).

Nickel Formate: $Ni(CHOO)_2 \cdot 2H_2O$. Mol. wt. 184.76. Sp. gr. 2.154. Green crystals. Decomposes when heated. Soluble in water. Grades: Technical. Containers: Bottles (1, 5 lb.); Drums (25, 50, 100, 450 lb.).

Nickel Hydroxide: $4Ni(OH)_2 \cdot H_2O$. Mol. wt. 388.84. Sp. gr. 4.1. Light green powder. Decomposes when heated. Insoluble in water. Soluble in acids, cyanide solutions, ammonium hydroxide. Grades: Technical. Containers: Bottles (1, 5 lb.); Boxes (25 lb.); Kegs (100 lb.); Barrels (250 lb.).

Nickel Monoxide: See Nickel Oxide, Green.

Nickel Nitrate: $Ni(NO_3)_2 \cdot 6H_2O$. Mol. wt. 290.80. Sp. gr. 2.05. M. P. 56.7° C. B. P. 136.7° C. Monoclinic, green, deliquescent crystals. Solubility, 239 at 0° C. Infinitely soluble in water above 56.7° C. Soluble in alcohol. Grades: Technical, Purified, C. P., C. P.—low cobalt. Containers: Bottles (1, 5 lb.); Boxes (25 lb.).

Nickel Oxide, Black: Ni_2O_3. Mol. wt. 165.38. Sp. gr. 4.83. Gray black powder. Also known as Nickel Sesquioxide, Nickelic Oxide, Nickel Peroxide. Reduced to nickelous oxide when heated to 600° C. Insoluble in water. Soluble in acids, cyanide solutions, ammonium hydroxide. Grades: Technical, C. P., C. P.—low cobalt. Containers: Bottles (1, 5 lb.); Cases (25 lb.); Kegs (100 lb.); Barrels (500 lb.).

Nickel Oxide, Green: NiO. Mol. wt. 74.69. Sp. gr. 6.6. Green powder. Also known as Nickelous Oxide, Nickel Monoxide, Nickel Protoxide. Changes to black nickel oxide at 400° C. Insoluble in water. Soluble in acids, ammonium hydroxide. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Cans (25 lb.); Kegs (100 lb.); Barrels (500 lb.).

Nickel Peroxide: See Nickel Oxide, Black.

Nickel Protoxide: See Nickel Oxide, Green.

Nickel Salt Double: See Nickel Ammonium Sulfate.

Nickel Salt, Single: See Nickel Sulfate.

Nickel Sesquioxide: See Nickel Oxide, Black.

Nickel Sulfate: $NiSO_4 \cdot 6H_2O$. Mol. wt. 262.85. Sp. gr. 2.07. Bluish green crystals. Also known as Single Nickel Salt. Loses water of crystallization when heated to 280° C. Solubility, 62.5 at 0° C. and 341 at 100° C. Soluble in alcohol, ammonium hydroxide. Grades: Technical, C. P., C. P.—low cobalt, C. P.—anhydrous powder. Containers: Bottles (1, 5 lb.); Bags (1, 10, 25 lb.); Cartons, Boxes (50, 100 lb.); Kegs (50, 100, 125 lb.); Barrels (300, 400, 425, 450 lb.).

Nickelic Oxide: See Nickel Oxide, Black.

Nickelous Oxide: See Nickel Oxide, Green.

Niobium: See Columbium.

Niter: A natural form of potassium nitrate, q. v.

Niter Cake: See Sodium Bisulfate, Anhydrous.

Niter, Chile: A natural form of sodium nitrate, q. v.

Nitrating Acid: See Mixed Acid.

Nitre: See Niter.

Nitric Acid: HNO_3. Mol. wt. 63.016. Sp. gr. 1.502. M. P. —42° C. B. P. 86° C. Transparent colorless or yellowish fuming and corrosive liquid. Also known as Aqua Fortis, Azotic Acid, Hydrogen Nitrate. Infinitely soluble in water. Soluble in alcohol. Grades: Technical 36°, 38°, 40°, 42° 43° Be.; U. S. P.; C. P. (Sp. gr. 1.42). Containers: Glass stoppered bottles (1, 7 lb.); Carboys (120-150 lb.).

Nitric Acid, Fuming: Nitric acid containing at least 86% HNO_3, usually having a specific gravity of 1.49-1.50. Also known as Nitrosonitric Acid. Grades: Technical, C. P. Containers: Glass stoppered bottles (1, 7 lb.); Carboys (120-150 lb.).

Nitric Acid, Red Fuming: Nitric acid having specific gravity of 1.59-1.60. Grades: Technical, C. P. Containers: Glass stoppered bottles (1, 7 lb.); Carboys (120-150 lb.).

Nitrogen: N_2. Mol. wt. 28.06. Sp. gr. 0.96724 (air = 1); liq. = 0.808. M. P. —209.9° C. B. P. —195.8° C. Colorless, odorless gas or colorless liquid. Very slightly soluble in water and alcohol. Grades: Technical. Containers: Steel cylinders (2, 8, 17, 60, 150, 200 cu. ft.).

Nitrohydrochloric Acid: See Aqua Regia.

Nitromuriatic Acid: See Aqua Regia.

Nitrosonitric Acid: See Nitric Acid, Fuming.

Ochre: A yellow, brown or red natural earth consisting mainly of hydrated ferric oxide mixed with clay and silica in varying proportions. Grades: Japanese, French, Synthetic, American. Containers: Boxes, Cartons (1, 5, 25 lb.).

Ochre, Burnt: Ochre which has been calcined to change the form of iron oxide from yellow to red. See Ochre.

Octadecanoic Acid: See Stearic Acid.

9-Octadecenoic Acid: See Oleic Acid.

n-Octadecylic Acid: See Stearic Acid.

Oils: See under type, such as Paraffin Oil; Vitriol, Oil of, etc.

Oleic Acid: $C_8H_{17}CH{:}CH(CH_2)_7COOH$. Mol. wt. 282.452. Sp. gr. 0.895. M. P. 14° C. B. P. 286° C. Oily, colorless to yellowish needles or liquid (commonly) with fatty odor. Also known as Red Oil, 9-Octadecenoic Acid. Insoluble in water. Soluble in alcohol, ether, benzene, chloroform. Grades: Technical, U. S. P. Containers: Bottles (1, 5 lb.); Cans (1, 7, 35 lb.); Kegs (10 gal.); Carboys (85 lb.); Drums (400-410 lb.).

Oleum: See Sulfuric Acid, Fuming.

Abbreviations: Mol. wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Orange, Cadmium: See Cadmium Sulfide.

Orient Yellow: See Cadmium Sulfide.

Orpiment: See Arsenic Sulfide-Tri.

Osmium: Os. At. wt. 190.2. Sp. gr. 22.48. M. P. 2700°C. Hexagonal, gray blue metal. Sponge or, in usual form, an amorphous powder. Insoluble in water. Soluble in nitric acid when finely divided. Grades: Technical. Containers: Bottles (1 g., 1 oz.).

Osmium Tetroxide: OsO_4. Mol. wt. 254.2. Sp. gr. 4.91. M. P. 40°C. B. P. 130°C. Yellowish monoclinic crystals or yellowish mass. Solubility, 5 at 0°C. and 6.2 at 25°C. Soluble in alcohol, ether, carbon tetrachloride, ammonium hydroxide. Grades: Technical. Containers: Bottles (1 g., 1 oz.).

Oxalic Acid: $H_2C_2O_4 \cdot 2H_2O$. Mol. wt. 126.068. Sp. gr. 1.653. M. P. 101°C. Sublimes at 150°C. Colorless, monoclinic crystals. Also known as Ethanedioic Acid, Acid of Sugar. Solubility, 9.5 at 15°C. and 120 at 90°C. Soluble in alcohol and ether. Insoluble in benzene, chloroform. Grades: Technical, C. P. crystals, C. P. anhydrous powder. Containers: Bottles, Cartons (1, 5 lb.); Boxes, Tins (5, 25, 50 lb.); Drums (25, 100 lb.); Kegs (110, 112, 125, 180 lb.); Barrels (300, 325, 450, 700, 900 lb.).

Oxomethane: See Formaldehyde.

Oxygen: O_2. Mol. wt. 32.0000. Sp. gr. 1.10527 (air=1). M. P. —218.4°C. B. P. —183.0°C. Colorless, odorless gas or slightly bluish liquid. Very slightly soluble in water, alcohol. Soluble in fused silver. Grades: Technical, Purified, U. S. P. Containers: Steel cylinders (2, 8, 17, 60, 150, 200 cubic ft.).

Oxytricarballylic Acid: See Citric Acid.

Ozokerite: Sp. gr. 0.85-0.95. M. P. about 70°C. but varies. A greasy natural wax composed of various hydrocarbons and having a color ranging from yellow brown to green or black. When pure, it is translucent but is usually opaque. Also known as Mineral Wax, Fossil Wax, Native Paraffin. Soluble in benzene, turpentine, ether, carbon disulfide, kerozene. Insoluble in water. Slightly soluble in alcohol. Grades: Technical, Crude, Refined; Green, Black, Bleached. Containers: Cartons, Tins (1, 5, 25 lb.); Stands (80-100 lb.); Bags (200 lb.).

Ozokerite, Purified: See Ceresin.

Palladium: Pd. At. wt. 106.7. Sp. gr. 11.40. M. P. 1555°C. Cubic, silvery white metal. Malleable. Ductile. Insoluble in water. Soluble in nitric acid, aqua regia. Soluble in hydrochloric acid when finely divided. Grades: Technical, Sheet, Wire, Sponge, Precipitated powder. Containers: Bottles (1 g.; ¼, 1 oz.).

Palladium Chloride: $PdCl_2$. Mol. wt. 177.64. Red deliquescent, cubic crystals and powder. Decomposes when heated. Slightly soluble in cold water. Soluble in hot water, hydrochloric acid. Grades: Technical, C. P. (5% solution); Containers: Bottles (1 g.; 1 oz.).

Palladium Cyanide: $Pd(CN)_2$. Mol. wt. 158.7. Yellowish white powder. Decomposes when heated. Insoluble in water. Soluble in cyanides, ammonium hydroxide. Insoluble in dilute acids. Grades: Technical. Containers: Bottles (¼ oz.).

Palladodiaminodichloride: $Pd(NH_3)_2Cl_2$. Mol. wt. 211.7. Sp. gr. 2.5. Tetragonal yellow crystals. Decomposes when heated. Very slightly soluble in cold water. Slightly soluble in hot water with decomposition. Decomposes in acids. Soluble in ammonium hydroxide. Grades: Technical. Containers: Bottles (¼, 1 oz.).

Palladodiaminodicyanide: $Pd(NH_3)_2(CN)_2$. Mol. wt. 192.8.

Palladodiaminodihydroxide: $Pd(NH_3)_2(OH)_2$. Mol. wt. 174.80. Microscopic yellow crystals or yellow crystalline powder. Very soluble in cold water. Decomposes in hot water.

Palladodiaminodinitrite: $Pd(NH_3)_2(NO_2)_2$. Mol. wt. 232.8. Yellow white crystals. Slightly soluble in cold water. Soluble in hot water. Grades: Technical. Containers: Bottles (¼, 1 oz.).

Palmitic Acid: $C_{16}H_{32}O_2$. Mol. wt. 256.416. Sp. gr. 0.853. M. P. 64°C. B. P. 339°C. Colorless crystalline needles. Also known as Hexadecanoic Acid, n-hexadecylic Acid, Cetylic Acid. Insoluble in water. Soluble in alcohol. Grades: Technical. Containers: Bottles (1 lb.); Barrels.

Paraffin: See Paraffin Wax.

Paraffin, Liquid: See Petrolatum, Liquid.

Paraffin, Native: See Ozokerite.

Paraffin Oil: Lubricating oil of 20-30° Bé with flash point from 300-450°F. Viscosity (Saybolt) 40-600 at 70°F. and 0°-40°F. cold test. Color ranges from pale yellow to dark green and the oil is often decolorized. Paraffin oil is also used as a synonym for Liquid Petrolatum, q.v. and for kerosene in some foreign countries.

Paraffin Scale: See Paraffin Wax.

Paraffin Wax: Sp. gr. 0.88-0.92. M. P. 42°-60°C. Mixture of hydrocarbons obtained from petroleum. White, semi-opaque, tasteless, odorless wax. In impure form, known as Paraffin Scale. Insoluble in water and in acids. Soluble in warm alcohol, carbon disulfide, turpentine, benzene, various hydrocarbons. Grades: Paraffin Scale—yellow and white; Refined, U. S. P. Containers: Cartons (1, 5, 10, 25, 50 lb.); Kegs (100, 200 lb.); Cases (200 lb.); Bags (220 lb.); Slabs of various sizes.

Paris White: See Whiting.

Pear Oil: See Amyl Acetate.

Pearl Alum: See Aluminum Sulfate.

Pearl Ash: See Potassium Carbonate.

Pearl White: See Bismuth Oxychloride.

Perchloric Acid: $HClO_4$. Mol. wt. 100.465. Sp. gr. 1.764. M. P. —112°C. Colorless, unstable liquid. Also known as Fraude's reagent. Explosive when concentrated. Infinitely soluble in water. Grades: Technical (20% and 68-70% solutions); Purified (68-70%); C. P. (20%, 60%, 70-72%); Containers: Glass stoppered bottles; Carboys (5, 10 gal.).

Perchloromethane: See Carbon Tetrachloride.

Peroxide: See Hydrogen Peroxide.

Petrol: See Gasoline.

Petrolatum: Sp. gr. 0.82-0.85. M. P. 45°-48°C. Colorless to amber colored jelly of varying consistency depending on the temperature. Chemically a mixture of hydrocarbons of methane and olefine series. Also known as Vaseline, Petroleum Jelly, White Vaseline, Mineral Jelly. Insoluble in water. Slightly soluble in alcohol. Soluble in most hydrocarbons, carbon disulfide, ether, chloroform, benzene. Grades: Technical, U. S. P. (amber, extra amber, white). Containers: Bottles, Jars, Tins (1, 5, 10 lb.); Drums (55 gal.); Barrels (350 lb.).

Petrolatum, Artificial: Petrolatum made by mixing a high viscosity paraffin oil, q.v. with a low melting paraffin wax, q.v.

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, = parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary

Patents

Zinc Coating

U. S. Pat. 2,325,240. L. O. Gill, assignor to A. E. Staley Mfg. Co., July 27, 1943. In the process of protecting metal wherein said metal is subjected to a bath of molten zinc and while said zinc is still in a molten state on the surface of said metal, applying a protective surface consisting of asbestos fibers, the improvement which comprises the step of applying asbestos paper having incorporated therein a soybean flour size which will become decomposed when exposed to said molten zinc and which will eliminate pungent and objectionable odors and fumes.

Corrosion Prevention of Steel

U. S. Pat. 2,326,309. G. C. Romig, assignor to American Chemical Paint Co., Aug. 10, 1943. The method of coating a ferrous surface which consists in subjecting the surface to a solution of acid zinc phosphate containing hydrogen peroxide and maintaining the operating pH of the solution by substantially continuous addition of a neutralizing agent for phosphoric acid, the solution being applied at not above 190° F.

Example:

Zinc oxide	1.5 lbs.
75% phosphoric acid	0.5 gal.
Water	0.5 "

Dilute for use to a zinc concentration of 0.1-0.5% and add 0.004-0.024% hydrogen peroxide. Maintain pH at 0.1-0.4 above the equilibrium by sodium hydroxide additions.

Cleaning and Pickling Agent

U. S. Pat. 2,326,837. T. J. Coleman, assignor to National Carbon Co., Inc., Aug. 17, 1943. An acidic cleaning composition that is stable in solid form, and adapted in aqueous solution to remove scale, oxide impurities, grease and oil from ferrous and non-ferrous metal surfaces, while inhibiting acid attack upon surfaces of aluminum, brass, copper, tin and lead, which composition comprises a solid alkali metal salt of an inorganic acid adapted in aqueous solution to hydrolyze and yield a free acid; a solid water-soluble salt of a compound selected from the group consisting of the sulfonation products of alkylated phenols and cresols having between nine and sixteen carbon atoms in the alkyl group, the sulfonation products of alkylated benzene having between nine and sixteen carbon atoms in the alkyl group, and the sulfonation and sulfation products of monohydric aliphatic alcohols having between eight and seventeen carbon atoms in the molecule; and a small amount of a solid water-soluble phosphate corrosion inhibitor.

Example:

Sodium bisulfate	3%
Sodium sulfonate derivative of tetradecyl phenol	0.4%
Ammonium phosphate	0.15%

Temp. 175° F.

Bright Nickel Bath

U. S. Pat. 2,326,999. R. Lind, W. J. Harshaw and K. E. Long, assignors to The Harshaw Chem. Co., Aug. 17, 1943. A bright nickel plating bath containing brighteners from the class of safranine compounds and ortho benzoic sulfimides.

Example:

Nickel sulfate	240 g./L.
Nickel chloride	37.5 "
Boric acid	37.5 "
Safranine Y	0.01 "
o-Benzoic sulfimide	2.0 "
Sodium lauryl sulfate	0.25 "
pH 4.0	Temp. 50°C.
Current density	40 amp./sq. ft.

Corrosion Prevention of Metals

U. S. Pat. 2,327,002. J. S. Thompson, assignor to Parker Rust Proof Co., Aug. 17, 1943.

A method of coating a surface of metal of the class consisting of iron, steel, zinc and their alloys which consists in applying to the surface to be coated an acidulous, aqueous solution containing the NO_3 radical and a metal from magnesium to nickel, inclusive, in the electromotive series as its chief chemicals and continuing the application of the solution to the surface until a visible, continuous, bonding coating is formed thereon composed essentially of oxides of the metal being coated and said metal from magnesium to nickel, inclusive, in the electromotive series.

Example:

Immerse for 5 minutes at about the boiling point in a 25-50 g./L. solution of aluminum nitrate.

Corrosion Prevention of Tin

U. S. Pat. 2,327,127. F. E. Rath, Aug. 17, 1943. A method of treating a tin surface bearing an oxide film to render the said surface substantially resistant to "yellow stain" by producing a protective phosphate film thereon, which consists in simply immersing the said surface in an aqueous solution of an alkali ortho-phosphate and phosphoric acid maintained at a pH value of from approximately 3.5 to approximately 2.5.

Example:

Immerse for 3 seconds at 200-212° F. in:

Disodium phosphate	100 g./L.
85% phosphoric acid	25 ml./L.
Chromic acid	2.5 g./L.
Duponol 80	2.5 "

Metallizing Non-Conductors

U. S. Pat. 2,328,101. E. F. Rosenblatt, assignor to Baker & Co., Inc., Aug. 31, 1943. The method of depositing ruthenium on surfaces comprising providing a coating composition containing a ruthenium compound dissolved in a liquid medium, distributing said coating composition over the surface and decomposing the ruthenium compound by heating under reducing conditions to form a coating of metallic ruthenium.

Example:

Ruthenium nitroso bromide	5 g.
Propanol	50 cc.
Methyl-iso-butanol	50 "
Phosphoric acid	1 "

This solution is applied and allowed to dry. Then the object is heated until ruthenium metal deposits on the surface.

Brightening Tin Coatings

U. S. Pat. 2,330,609. J. S. Nachtman, Sept. 28, 1943. A process for brightening an electrodeposited stannous metal coating on a metal strip, said stannous metal coating having a substantially dull, film or matte-like surface appearance produced by the electroplating operation; including the steps of immersing the strip in a hot bath of an aqueous solution of an acid at least 2.5% by weight of an acid having neutral or reducing properties when used in hot solutions maintained at a temperature of from 170° F. to 210° F. for up to 15 seconds to remove said film, rinsing the coating to remove the bath solution, then heating the strip to melt the coating and then cooling the strip to solidify the coating and provide a mirror-like surface appearance.

Anodizing Basket

U. S. Pat. 2,331,071. A. Halvorsen, assignor, by mesne assignments, to Boeing Aircraft Co., Oct. 5, 1943. A process for anodizing a multiplicity of aluminum rivets and like parts, which comprises packing them sufficiently tightly within a perforated aluminum container to effectively immobilize the individual rivets during subsequent treatment, positively holding the rivets in such condition, connecting the container to the anode of a normal anodic treatment bath, immersing the rivets, within the container, within such bath, under film-forming conditions, and forcing bath liquid under pressure into the mass at a multiplicity of points within the mass, the liquid pressure being sufficient to force the liquid through the interstices and through the perforations of the container, and between the pressed-together surfaces of the rivets, against the resistance offered by the tightly packed rivets, and the immobilizing pressure upon the rivets being sufficient to maintain them immobile under the separating influence of the liquid pressure.

Corrosion Prevention of Iron and Steel

U. S. Pat. 2,331,196. G. W. Jernstedt and J. C. Lum, assignors to Westinghouse Electric & Mfg. Co., Oct. 5, 1943. An aqueous solution for application to metallic surfaces to activate the surfaces to provide for subsequent rapid formation of uniform, fine crystalline coatings of phosphates when the surfaces are subjected to phosphate solutions, which comprises the reaction product of from one to ten parts of disodium phosphate and one part of citric acid, the solution containing ¼% to 5% of the reaction product and from 0.01% to 0.001% of ferric iron, the solution being characterized by a substantially uniform hydrogen ion concentration.

Example:

1¾ lbs. of citric acid are dissolved in 2 gallons of solvent such as ethanol, and 9 lbs. of dialkali phosphate such as disodium phosphate containing from 0.1-1% of ferric iron suitable for activating metal surfaces is added to the solution. The precipitate is filtered out and the alcohol may be reused. The precipitate is dissolved in water to form a ½-5% solution.

The article is immersed in the above solution for 45 seconds and is then treated in a phosphating solution such as is produced by diluting the following concentrate to 2-4%:

Manganese phosphate	1¾ lbs./gal.
83% phosphoric acid	5 "
Sodium nitrate	½ "
Cupric nitrate	¼ oz./gal.

Polishing Wheel

U. S. Pat. 2,331,583. R. V. Twyning, assignor to J. C. Miller Co., Oct. 12, 1943. The method of treating a fabric wheel which consists in impregnating the fabric of said wheel with tricresyl phosphate carried suspended in a water solution of silicate of soda and thereafter baking said wheel at a temperature and for a time sufficient to expel the water.

Polishing Stainless Steel

U. S. Pat. 2,331,721. J. N. Ostrofsky, assignor to Rustless Iron and Steel Corp., Oct. 12, 1943. As an electrolyte for the anodic polishing of stainless iron and stainless steel, a mixture consisting esentially of a water-soluble aliphatic carboxylic acid, less than approximately 10% by volume of a member of the group consisting of the mono-, di- and tri-hydric aliphatic alcohols and mixtures thereof having 1 to 5 carbon atoms, said alcohol serving to inhibit crystallization upon chilling the bath, a soluble compound having a sulphate radical providing a sulphate ion in the bath, and water in an amount less than approximately 50% by weight of the bath.

Example:

Citric acid	60%
Sulfuric acid	15%
Water	25%
Methyl alcohol	4%

50-125°C., 1-3 min., ½-40 amp./sq. in.

Hard Nickel Bath

U. S. Pat. 2,331,751. A. Wesley, assignor to The International Nickel Co., Inc., Oct. 12, 1943. A process for rapidly electrodepositing nickel plating of extremely high hardness and of good adherence on a base having a hardness of at least about 227 Vickers which comprises establishing a nickel electroplating bath comprising an aqueous solution containing at least 25 grams per liter of nickel provided by at least one electrolyte-soluble nickel electroplating salt yielding nickel cations and at least 5 grams per liter of ammonia provided by at least one ammonium salt yielding ammonium cations, adjusting the pH of said nickel electroplating bath within a range of about pH 5.4 to about pH 6.1 (quinhydrone) to provide suitable acidity in said bath without crystallizing and the like, maintaining the temperature of said bath within a range of at least 100° F. and electrodepositing nickel at a cathode current density within a range of about 25 amperes per square foot to about 150 amperes per square foot at a cathode having a hardness of at least about 227 Vickers disposed in said bath whereby an extremely hard nickel plate is consistently produced having a satisfactory hardness of at least about 400 Vickers at a commercially practicable rapid rate of at least about 0.1 inch in about thirty-eight hours.

Example:

Nickel sulfate	120 g./L.
Ammonium sulfate	20 "
Potassium chloride	8 "

117-155° F., 50-150 amp./sq. ft., pH 5.7-5.8

Example:

Nickel chloride	102 g./L.
Ammonium chloride	17 "
Potassium chloride	8 "

110-120°F., 50 amp./sq. ft., pH 5.8-6.0

Vitreous Enamel

U. S. Pat. 2,332,236. H. C. Kremers and L. A. Bateman, assignors to The Harshaw Chem. Co., Oct. 19, 1943. A process of producing a ceric oxide of superior opaquing properties in vitreous enamels comprising calcining a cerium oxide, NaOH and a phosphate, the cerium oxide and NaOH being in proportion to form $Na_2O{\cdot}CeO_2$ plus or minus 15 mol per cent and the phosphate radical being present to the extent required to yield phosphate radical to the extent of from 0.2% to 0.8% of the CeO_2 in the final product, the temperature of calcination being from 700° C. to 900° C. and the time from ½ hour to 1½ hours, and decomposing the calcination product by the action of water.

Metal Coating

U. S. Pat. 2,332,309. F. E. Drummond, assignor, by mesme assignments, to The Commonwealth Engineering Co., Oct. 19, 1943. An apparatus for plating continuous metal strips comprising a generator for forming a volatile metal compound, a compartment for receiving volatile metal compound, means for moving said strip through said compartment, means for hermetically sealing said compartment, means for circulating the volatile metal compound from said generator into said compartment and in contact with said metal strip material, means for decomposing said volatile metal compound to deposit said metal onto the surface of the strip material, and means for conducting the gaseous decomposition products away from said compartment and back to the generator.

Sandblasting Nozzle

U. S. Pat. 2,332,407. C. D. Spenle (England), Oct. 19, 1943. A sandblasting nozzle having an exterior body portion which is a single entity, said body portion adapted to receive and be fitted with rearward and forward adjustable and fixable longitudinal abutting liner elements of wear resisting metal or alloy, which elements provide a complete interior to the nozzle to produce a built-up tapering rear nozzle compartment of abutting elements and a forward nozzle compartment of abutting elements, the aforesaid rearward liner elements in the rear compartment adapted to be taken out and re-ground or renewed and re-assembled, screw devices to fix same, the liner elements in the forward compartment being adapted to be reversed or inverted, ground or renewed as may be requisite, screws to fix said liner elements in the forward compartment, all whereby re-ground or fresh liner surfaces can be brought into use to produce a restored or new interior to the rear compartment of the nozzle, and freshly disposed or changed faces for the liner elements of the forward compartment, all so that a reconstituted or fresh cross-sectional area of the liner elements is obtained for the forward compartment approximating to the original bore or outlet of the nozzle, in manner described herein.

Vitreous Enamel

U. S. Pat. 2,332,423. C. H. Zwermann, Jr., Oct. 19, 1943. The method of making enamel comprising the steps of grinding vitrified frit to produce a product comprising predominantly particles of a size less than four microns, intimately mixing finely divided opacifier, and heating the mixture sufficiently to merely soften the frit particles to permit the surface tension thereof to reduce the overall size thereof.

Vitreous Enamel

U. S. Pat. 2,332,424. C. H. Zwermann, Jr., Oct. 19, 1943. The method of producing titanium dioxide enamel comprising intimately mixing finely divided titanium dioxide in the anatase form with vitrified frit comprising predominantly particles of a size of four microns or less, and heating mixture at a temperature of approximately 1280° F. for approximately one hour.

Corrosion Prevention of Magnesium

U. S. Pat. 2,332,487. W. S. Loose, assignor to The Dow Chem. Co., Oct. 19, 1943. A method of treating articles of magnesium and its alloys comprising subjecting the article to the action of an aqueous solution consisting essentially of acid fluoride, and thereafter, without rinsing off the fluoride solution, subjecting the treated article to the action of an aqueous solution of an alkali.

Example:

Immerse at from room temperature to boiling for ½ to 10 minutes in a 20% solution of hydrofluoric acid. The article may be made anode in this solution at 90-100 volts.

Then immerse in a saturated solution of calcium hydroxide for 3 minutes at room temperature. This solution may also be used as an anodizing solution at 50-60 volts and 50° C., in which case the pH is kept above 12 by additions of caustic soda.

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Cyanide Nickel Plating Solutions

Question: We would appreciate your furnishing us with a formula for a cyanide nickel solution and advising us as to how to make cyanide nickel from nickel salt. This is to be used in plating some tubes carrying high defense priority.

The tubes in question are to be first nickel plated, then gold plated. The regular nickel solution does not seem to plate in the small tubes which have about ⅜" inside measurement. The tubes are about 12" long and closed on one end. We believe that the reason they do not plate inside with an inside anode is that there is no circulation in the regular nickel, whereas we understand a cyanide solution will readily plate in same.—S. P. W.

Answer: We do not know of any satisfactory solution for your purpose although cyanide solutions have been suggested for depositing alloys of both nickel and silver and nickel and tin. If you wish to try these, the formulas are as follows:

NICKEL-TIN BATH—

Ref.: Monk and Ellingham, Trans. Faraday Soc., *31*, 1460 (1935).

Tin as stannate	90-100 g./L.
Nickel as cyanide	2 "
Potassium cyanide	5 "

Nickel anodes are used which are insoluble in the solution at a current density of 1½-5 amp./sq. ft. The deposit contains 18-25% nickel, the balance tin. Higher nickel content results in brittle deposits.

NICKEL-SILVER BATH—

Ref.: French Patent No. 668,800.

Nickel carbonate	180 g.
Potassium cyanide	60-100 "
Silver cyanide	50 "
Benzoic acid	10 "
Salicylic acid	20-25 "
Ammonia	10 cc.
Water	10 L.

We doubt that any solution will throw into a closed tube 12 inches long and only ⅛ of an inch inside diameter.

We believe a possible reason for unsatisfactory results with an inside anode may be the blowing out of the solution by the gas liberated in the tube during deposition. You might try the addition of a wetting agent to the nickel solution as this will cause the liberated gas to rise as a very fine mist rather than as large bubbles, thus possibly eliminating the blowing out of the solution from the tube.

To prepare nickel cyanide from nickel salt, dissolve 1.45 lb. single nickel salt in a gallon of water and add 0.54 lb. of sodium cyanide dissolved in a half gallon of water. On mixing, the nickel cyanide tetrahydrate is precipitated and can be washed by decantation or in a filter until testing the wash water with barium chloride solution shows that all of the sulfate has been washed out. The above quantities of nickel salt and cyanide will give you one pound of nickel cyanide tetrahydrate.

Rather than prepare the nickel cyanide yourself, you would probably find it more convenient to purchase the salt from a plating supply house.

Codeposition of Abrasive Powder and Copper on Steel

Question: Please furnish details of a procedure of an abrasive powder, such as carborundum, with copper on steel surfaces.
—S. S. W. D. M. Co.

Answer: Methods have been worked out for incorporating diamond powder in an electrodeposited matrix. However, since carborundum and similar abrasives are not conductors of electricity to any appreciable extent, we do not know whether the same procedure would work with them. In any case, there are no details available on the plating procedure which would therefore have to be worked out on an experimental basis according to the results you desire.

Sparkproof File for Steel

Question: We are pressing a powder sensitive to spark into a cavity in a steel body. The steel body is cadmium plated. It would be convenient to file the powder to flush with the body but a sparkproof file is necessary. Any metal or alloy which is hard enough to stand light contact with the steel would be satisfactory as the powder is relatively soft.

Are you able to suggest an alloy which would meet the requirements of this job? Would a hard chromium plated file be sparkproof when used on steel?—R. Corp.

Answer: Chromium will be satisfactory for this purpose. The chromium will not only be non-sparking but in addition, will increase the life of your files appreciably.

Gypsum to Remove Sodium Carbonate from Cadmium Solutions

Question: This depot is very interested in securing information regarding the special gypsum used in removing sodium carbonate from cadmium plating solutions. It will be appreciated if your office will furnish us with this information or inform us where such is obtainable.—R. A.

Answer: We would advise that this process has been the subject of U. S. Pat. No. 2,164,924 assigned to E. I. du Pont de Nemours & Co. This company markets the material as a fine powder suitable for direct addition to the plating solution under the name of Du Pont Carbonate Remover. To remove one ounce of sodium carbonate, 1.6 ounces of gypsum are required.

Lowering the pH of Zn and Cd Cyanide Baths

Question: Will you kindly enlighten me as to the possibility of using surfuric acid in lowering the pH of a zinc or cadmium cyanide bath, providing proper ventilation conditions are maintained. Is this the proper industrial method? If not, will you suggest the proper methods to lower the pH of a zinc or cadmium cyanide bath?—A. A. L.

Answer: If proper ventilation facilities are available, addition of acid is a suitable industrial method to lower the pH of zinc and cadmium cyanide baths. However, since these solutions are highly buffered in their ordinary operating ranges, you may find that an appreciable amount of acid is required to lower the pH, especially in the case of zinc solutions which contain much free caustic soda.

Are you sure that lowering the pH of your solution is the answer to your problem? Ordinarily, the control of pH is not considered necessary in the operation of these solutions and control of metal, cyanide and caustic content is general practice.

Tarnish Removal from Silverware

Question: Will you please furnish me with a method for removing tarnish from silverware?—J. S.

Answer: To remove tarnish from silverware, we suggest either immersion in a solution containing 4 oz./gal. sodium cyanide or the electrolytic method commonly used by housewives.

In the electrolytic method, a solution containing approximately 2 oz./gal. of washing soda, or sodium bicarbonate, is heated in an enamel pot and the tarnished silverware is immersed in this solution in contact with a piece of aluminum or zinc. Heavy tarnishes are removed in a very short time with this procedure.

List of Finishes

Question: I am interested in obtaining a list or classification of all available types of finishes now in use, both standard and those covered by commercial trade names or patents. This should include plated, painted, ground, polished, chemical and other types of finishes. I was wondering if anyone had compiled a list of finishes listing trade names, types and properties and if so, I would greatly appreciate learning where I could obtain such information.—A. A.

Answer: The names of the common finishes can be obtained by going through the Table of Contents of any book on metal coloring and finishing.

We do not know of any up-to-date listing of finishes sold under trade names and can only suggest the Trade Names' Index which will probably be a few years behind in their lists.

Silver Plating of Brass and Bronze Contacts

Question: We would like to plate some brass and bronze contacts with 0.001" of silver and would like to be sure as to the solution to use, the kind of tank and what other equipment is necessary. We had intended to use a steel tank and equipment similar to that used in plating flatware with a motion and anodes encased in linen bags. Would it be necessary to have a filter in the tank also?—A. H. and H. E. Co.

Answer: Details on the solution and operating conditions are to be found on pages 32-5 of the 1943 edition of the *Plating and Finishing Guidebook.*

Equipment which has been used for plating flatware will be satisfactory.

In order to get a smooth deposit and at the same time deposit the thickness desired, it is advisable to use a filter either continuously or intermittently.

Deposition of Lead-Tin Alloy

Question: I have been trying to deposit an alloy containing approximately 4% tin with the balance lead, using a fluoborate solution at 35 amp./sq. ft. I have been adding sodium stannate and caustic soda to get the tin but find it very difficult to control the composition of the deposit from day to day. Do you have any information or references on this subject which would be of help?—A. R.

Answer: According to Gray and Blum (Trans. Electrochemical Society, *80*, 1941), the fluoborate solution is satisfactory only for lead-tin alloy deposits containing between 25 and 75 per cent tin. Alloys containing either lead or tin outside of this range of composition cannot be deposited from the fluoborate solution consistently because the potentials are too far apart.

A number of other tin-lead baths may give better results than the fluoborate bath, especially those containing fluosilicate. We refer you to the following patents for details:

Fluosilicate solutions	—U. S. Pat. 1,842,028
Stannate solutions	—U. S. Pat. 2,078,014
Sulfone solutions	—U. S. Pat. 2,313,371

The fluosilicate solutions have been used by one refinery for some time for depositing an alloy of lead-tin for solder purposes.

Flow of Current in Electroplating Tank

Question: As a subscriber to *Metal Finishing*, I would like to know whether you can clear up a problem over which I have had quite a controversy. Which way does the flow of electricity travel in a cadmium tank? Does the current come in the positive or negative side? Does it come in the positive side and change its course under the solution or does it come in the negative side and flow towards the anode or positive side? Does the same apply to all plating tanks?

—C. E. W.

Answer: From a technical standpoint, the flow of current (which is really the flow of electrons) is from the negative terminal to the positive. However, in practical electroplating, the travel of the metallic ions would be from the positive to the negative and it is customary in plating practice to designate the path of current as flowing from the positive terminal to the negative.

Determining Water Hardness

Question: We are interested in your method of determining hardness for water for the application of soap for burnishing purposes. Please send to the attention of the writer the method of conducting the test.

—S. C. Co.

Answer: A simple way to determine the hardness of the water supply is with the standard soap solution. The procedure is as follows:

1. Place 50 cc. of the water to be tested in a 4 oz. oil sample bottle and mark the upper point.
2. From a dropping bottle, add 9 drops of standard soap solution and shake vigorously.
3. If 1" head of suds forms and remains stable after 1 minute, the water is zero hard.
4. If not, add more standard soap solution, 15 drops at a time, shaking after each addition until the stable layer of suds 1" high forms. The number of drops of standard soap used divided by 30 is the hardness of the water in grains per U. S. gallon.

The standard soap solution may be purchased from any large laboratory supply house or, if facilities are available, can be prepared as follows:

1. Run 28.5 cc. normal potassium hydroxide solution into a flask and add a few drops of phenolphthalein indicator.
2. In a separate container, dissolve 10 grams of oleic acid in 75 cc. of neutral ethyl alcohol.
3. Add oleic solution to the potassium hydroxide agitating continuously until the pink color disappears.
4. Dilute with 1,000 cc. ethyl alcohol.

Solutions for Immersion Cu and Sn Deposits

Question: I am interested in obtaining technical data on copper coating and tin coating steel by the immersion or acid process which is performed without the help of an electric current.—A. F.

Answer: For immersion copper a commonly used solution contains 1 oz./gal. copper sulfate crystals and ½ oz./gal. surfuric acid. For tin deposits, a boiling solution containing 3 oz./gal. ammonium alum and ½ oz./gal. tin chloride crystals may be used.

It is, of course, important that the articles be perfectly clean before entering the solutions.

Plating Noble Metals on Porous Refractory

Question: We are interested in plating a porous, non-conductive refractory material having small pores with the noble metals. Can you give us the names of plating companies who could carry out this work?

—D. O. & R. Co.

Answer: If the refractory is absorbent, it will be necessary to fill the pores before attempting to plate in order to avoid filling them with the plating solution. If this is allowable, we suggest that you contact a local job plating shop which may be equipped to do the work.

Coloring Steel

Question: I am interested in obtaining information on the formation of a dark, tightly adhering coating on copper and also that of a dark, non-reflecting and wear resistant coating on stainless, galvanized, tinned and cadmium plated steel. If you have any information concerning such coatings, I would appreciate your forwarding it to me.—J. W.

Answer: Data on coloring may be obtained from the 1942 edition of the *Plating and Finishing Guidebook*, from Hugo Krause's *Metal Coloring and Finishing* and from A. H. Hiorns' *Metal Colouring.*

Materials for coloring metals are obtainable from a number of manufacturers. If you wish details, we suggest that you communicate with manufacturers, such as are listed in our *Buyers' Directory.*

Coating on stainless steel are covered by a number of patents issued to Batcheller for solutions containing an acid and a combination oxidizing agent and etching inhibitor. The patents are as follows: U. S. 2,172,353; 2,283,170-1; 2,312,066.

Tarnishing of Copper Plated Drop Wires

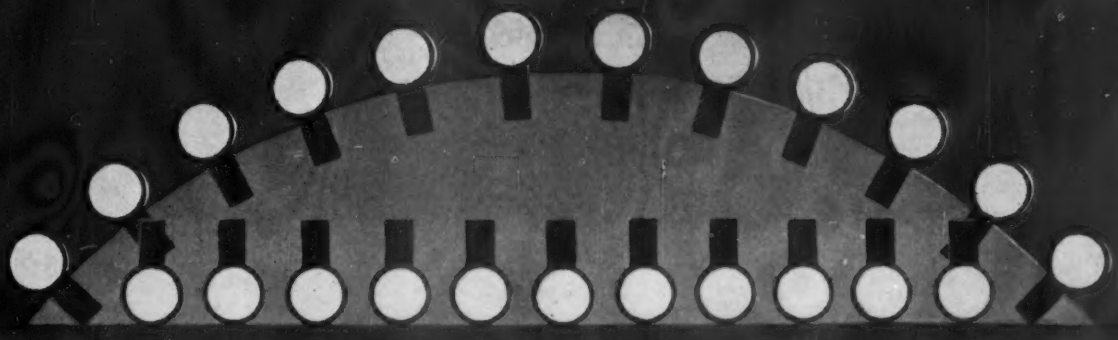
Question: I am enclosing a few drop wires that have been copper plated. They come out bright from the solution but after being dried out and standing for a few hours, they tarnish badly. Is there any way of stopping this tarnishing? Could they be run through any solution before being dried which would avoid this condition?—E. H. B.

Answer: The tarnishing may be due to contaminated rinse water or to fumes in the atmosphere.

We suggest that you use a tenth of an ounce per gallon of ordinary flake soap and one or two balls of sodium cyanide in your hot water rinse. This will produce a very thin film of soap on the surface and will minimize tarnishing. The film is too thin to interfere with any subsequent operations which may be performed on the plated work, such as lacquering or polishing.

CLEANER 100

THE MODERN ALKALI CLEANER FOR STEEL



SURFACE ACTIVE FORCES IN CLEANER 100 START TO DISPLACE AND EMULSIFY AN OIL DROP ON STEEL

THE ENTHONE CO.

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NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Washing Machine

N. Ransohoff, Inc., Dept. MF, Township Ave., Cincinnati, O., has announced its development of a new revolving unit for washing, rinsing and drying metal parts. It is called the "Ransohoff Rotomatic".

The method of procedure is reduced to simple steps. First the work is hung on fixtures from which it is cleaned in a series of rotating pivoted baskets which are loaded and unloaded automatically. Then it is put in removable baskets and placed on a revolving table.

The machine occupies 7½ ft. x 6½ ft. and the driving mechanism and all the bearings are mounted on top in order to obviate the possibility of their coming in contact with the cleaning solution.

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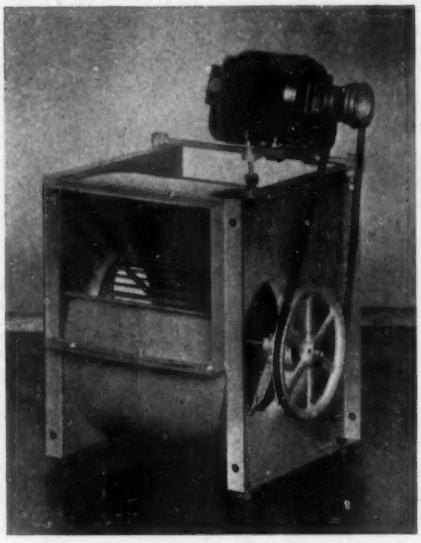

Blowers

A complete new line of "Quad" 4-way interchangeable blowers has been announced by Trade-Wind Motorfans, Inc., Dept. MF, 5725 S. Main St, Los Angeles, Cal., manufacturer of air moving equipment.

This new series is the culmination of five years of pioneering and incorporates such features as unit welded steel construction, streamlined inlet fittings, handy motor mount, balanced blower wheel and adjustable bearing oiler. Wheel diameter sizes range from 6 to 25 inches.

Its design uses a new style of blower housing that acts as the frame and is rugged and weave-free. This is accomplished by the welding of a heavy scroll sheet between two end plates thus forming a beam inside of which the balanced blower wheel is installed. The blower may be driven from either right or left and a new type motor mount permits the driving motor to be quickly attached on the job to the top, rear or front of blower frame permitting outlet interchangeability to fit varying conditions. The bearing oiler can also be easily moved so that oiling cup is always upright and accessible.

The streamlined inlet is die stamped in each side of the blower, assuring quiet, efficient operation. All models are provided with cushioned feet attachable to any of the four positions.

Sawtooth Anode

A new type of lead anode for electroplating has been developed by the Heil Engineering Co., Dept. MF, 12901 Elmwood Ave., Cleveland, O. Known as a "sawtooth" anode, it differs from the standard flat anode in several ways.

The multi-angled surface gives 50 per cent more area than a flat anode, resulting in greater electrical efficiency and throwing power, and the multiple edges increase the anode's effectiveness when used between two work rods.

One side has ten edges and the other side has a central spine a half inch thick running down the center. This spine connects directly with the hook, which doubles the average anode life and provides greater current carrying capacity from top to bottom. The angular construction lends rigidity and offers resistance to buckling or warping.

These anodes are made of extruded lead, which has a denser structure than cast lead and offers more resistance to corrosion effects. Hooks are coated and integrally bonded to the anode to provide a continuous metal conductor. Five standard hook styles are available, designed for varying uses of anodes, and special hooks may be had on request.

The "sawtooth" anode is manufactured to sell in the same price range as standard flat anodes.

Industrial Gloves

Seiberling Latex Products Co., Dept. MF, Akron, O., are the manufacturers of a gauntlet type industrial glove made of all Neoprene Latex which has been steam cured. It is said to be impermeable to practically all acids and caustics and to be highly resistant to oils and greases. The 14-inch length of the gauntlet protects arms as well as hands. The gauntlet end is rolled edge finished.

Air Blaster

Chelsea Fan & Blower Co., Inc., Dept. MF, 1206 Grove St., Irvington, N. J., has announced a new unit which delivers a large volume of air in a straight line to the spot where it is needed. It is said to be unlike ordinary fans in that the discharge expands only slightly and continues at a high velocity air stream over larger distances.

The unit consists of a heavy gauge welded steel housing mounted on an adjustable pedestal which may be tilted 60° up or down. It is driven by a direct connected, ball bearing motor. The fan blade is of heavy steel, die cut, die formed and perfectly balanced.

". . . . . experiments indicate that the new (Beckman) high-alkaline type glass electrode is the first practical and accurate method for pH control of cyanide plating baths."

Gray—Proc. Am. Electroplaters' Soc.

BETTER DEPOSITS AT HIGHER PLATING SPEEDS with *Beckman* pH CONTROL!

Type "E" Glass Electrode Equipment Vital Aid for Cadmium, Copper, Zinc, Brass and Similar Plating Operations

With today's urgent need for higher speeds, greater efficiencies, reduced losses in ALL plating operations, Beckman pH Control is a "must" for modern plating plants. For Beckman is the *only* pH equipment that is equally efficient in all plating baths, acid or alkaline, *regardless of color, turbidity, organic substances, or oxidizing and reducing agents!*

And Beckman is the only modern pH equipment providing glass electrodes that can be used in highly alkaline solutions, *even in the presence of sodium ions.* This Beckman development is an invaluable aid to such plating operations as cadmium, copper, zinc, brass (both rubber-adhesion and straight brass plating) and similar plating operations. By using it you can obtain better deposits—at higher plating speeds—with fewer rejects!

Write our engineering department for further information and descriptive literature!

BECKMAN INSTRUMENTS
NATIONAL TECHNICAL LABORATORIES
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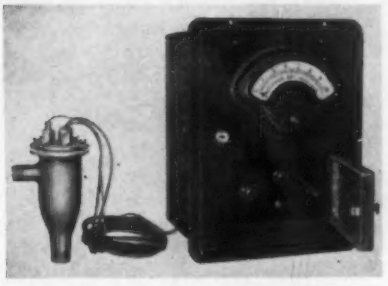
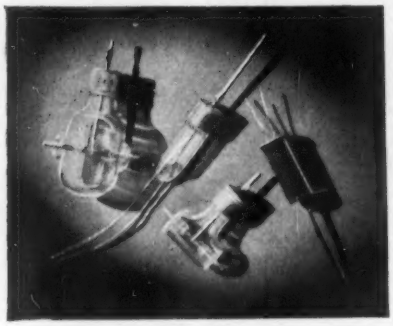


The Beckman Automatic pH Indicator—the most advanced instrument available today. Continuously indicates pH fluctuations and can also be equipped to provide a written record and completely automatic pH control. Ideal for maximum efficency in large-scale plating operations. *Write for Bulletin 16!*

The Beckman Industrial pH Meter—ideal for portable plant and field use. It combines laboratory accuracy with a ruggedness and a simplicity of operation that permit quick, accurate pH measurements on all types of plating baths by even inexperienced help. *Write for Bulletin 21!*

Beckman THE LEADING NAME IN pH



Vacuum Switches

Four new vacuum switches for a wide variety of radio and industrial switching applications have been announced by the Tube Division of the General Electric Company's Electronics Department at Schenectady, New York They can also be adapted to oil- or water-immersed operation because of their enclosed construction and are said to be especially applicable for hazardous installations where fire and explosion are a constant risk, as in flour mills, magnesium finishing rooms, and similar dust-laden atmospheres. Two of the new switches are also designed for high altitude applications.

Since the contacts of the switches are mounted in a vacuum, they are relatively free from the effects of corrosion and arcing, and are unaffected by dirt or oxidation. The vacuum-type construction also gives the switches a high current rating for their size and permits them to handle enough power to operate equipment at greatly reduced voltages.

Operating without auxiliary contactors or relays, the switches can be used on installations where space is at a premium, as in airplanes. No self-contained coil or other operating mechanism is built into the switches. Movement is obtained from the mechanism to be controlled, or from other apparatus to suit the application. This movement can often be provided by a slow-moving cam or by the movement of a thermostat, as in air-conditioning or refrigerating equipment. Air or liquid bellows, a rod-linkage system, or almost any other means can be used to operate switches of this type.

An external fulcrum is eliminated by the use of a flexible diaphragm which transmits movement to the contacts and acts as a natural fulcrum point for the operating arm. The contacts close without vibration, making it possible to mount these switches on or near delicate instruments.

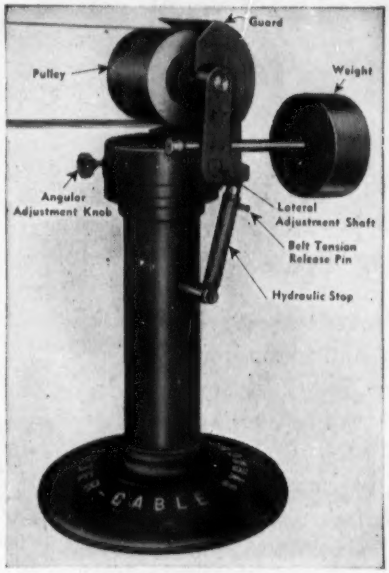
Electric Tachometer

A self-energized tachometer that can be used either as a "Hand Type" or "Separable Type" has been announced by the Ideal Commutator Dresser Co., 1941 Park Avenue, Sycamore, Ill.

Essentially, the unit consists of a small generator, coupled electrically to an electric meter. The generator itself consists of a small, permanent "Alnico" magnet rotor which is mounted on precision sealed ball bearings and capable of continuous operation at any speed with limit of the meter.

The meter or indicating instrument is a rectifier type, including a sturdy D'Arsonval movement. It is capable of withstanding a momentary overload up to four times the maximum speed indication without damage. The meter is provided with two scales—"Hi" and "Lo". The "Hi" scale indicates the maximum reading obtainable. A small switch incorporated in the meter case provides for easy changing from "Hi" to "Lo" range.

The generator and meter are made as distinctly separate elements and coupled together by a precision made bayonet lock. The units may be used together as a "Hand Type" tachometer, or for many applications including permanent mounting, the generator and meter may be separated—"Separable Type" and connected only by a two conductor electric cord. A 5 ft. cord complete with coupling plug is provided, but a cord up to several hundred feet long (of proper size wire) can be used without introducing an appreciable error in scale reading.

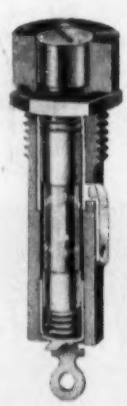


New Backstand Idler

As a new addition to its line of abrasive belt grinders, the Porter-Cable Machine Co., Dept. MF, Syracuse, N. Y., has announced its Model ABS backstand idler.

This idler is used to adapt grinding and polishing lathe (jacks) to abrasive belt grinding.

The backstand idler is recommended for grinding welds, flash generating radii, flat and edge work, cleaning up, polishing, etc. Any width belt up to 6" can be used.



Extractor Post Terminals Connected by Welding

What is considered a most important advance in fuse extractor post construction comes from Littelfuse, Inc., Dept. MF, 4747 Ravenswood Ave., Chicago 40, Ill. The new improvement is illustrated in Littelfuse Extractor Post for 3 AG (1¼"x1¼" dia.) fuses.

Anti-vibration side terminals are now mechanically connected by electrical welding to the metal shell inside the bakelite body and backed up by soft solder. The new welding process makes the terminal connection in effect one-piece, integral with the metal parts. The terminal is proof against heat and vibration.

The new Littelfuse Extractor Post No. 1075 for fuses to 15 amperes is used for radios, auto-radios, amplifiers, fractional h.p. motors, magnets, control circuits, relays, rectifiers, plate circuits, etc. Overall length is 2½". Length from front to panel 2⅛"; mounting hole ½"; maximum current, 15 amperes. It is furnished for screwdriver operation meeting Underwriters' specifications, or for finger operation.

Knob and body are molded of black bakelite, impervious to temperature changes and corrosion, and are thoroughly insulated. Spacing between live parts gives adequate protection against electrical leakage. The tool-operated types have a red knob.

The fuse grip permits full visual shock-proof inspection of fuse. A spring-activated cup at the bottom insures positive and continuous electrical contact.

The knob not only pulls the fuse, it holds it. A specially designed grip prevents the fuse from dropping out. The fuse can be taken from the knob only by hand.

Thermoplastic Coatings

An additional development in thermoplastic coatings just announced is the compound called Amercoat No. 33, for application on metal, concrete or wood. This product is a liquid plastic which is cold and is applied by conventional spray or brush methods. It has a distinct practical advantage in that it may be applied in any number of coats required for any particular condition or use.

Amercoat No. 33 is a combination of the most inert synthetic resins obtainable and is the result of two years development and test both in the laboratory and in the field. It has shown excellent performance in such applications as: lining for storage tanks and other equipment to protect foods from contamination by corrosion caused by dilute acids or caustics; for super-structures, deck machinery, ventilators and other marine equipment; for concrete urinals, shower bases and laundry trays in defense housing, Army, Navy and air bases, shipyards, factories, etc.; for protecting machinery and equipment in chemical plants, bottling plants, breweries and dairies from corrosion caused by acids and caustics.

Full details on Amercoat No. 33 are contained in a new bulletin obtainable from the American Pipe & Construction Co., Dept. MF, P. O. Box 3428, Terminal Annex, Los Angeles, Calif.

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List these names for your Metal Cleaning Reference. These products typify the Finest in Metal Cleaning Technique.
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Black Finish for Steel & Iron
One bath, low temperature salts

Let our Technical Department Process Samples for you.

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A hard adherent black for zinc and zinc die castings

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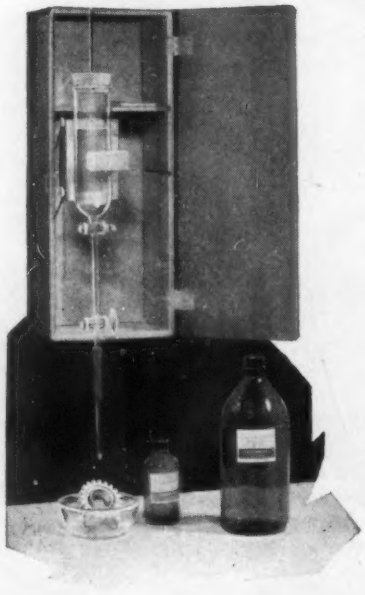

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Manufacturers' Literature

War-Time Tool Maintenance

"How To Get The Most From Your Portable Electric Hools" is the title of a special section in the new catalog published by *Skilsaw, Inc.*, Dept. MF, 5033-43 Elston Ave., Chicago 30, Ill. Designed as a handy guide to greater production and longer tool life this manual is full of illustrations and valuable suggestions on the care and operation of portable electric tools.

This new catalog also carries complete data on and working illustrations of the company's portable electric tools.

Industrial Trucks

To acquaint industry with their war-standardized line of electric industrial trucks, *The Yale and Towne Manufacturing Co.*, Philadelphia Division, recently published a 76-page catalog. The booklet contains detailed descriptions of all models, as well as a great many application illustrations, showing many uses of industrial power trucks.

A separate section is devoted to the workings of the War Production Board's Limitation Order No. L 112, as applied to industrial trucks.

Copies of this catalog are available on request.

New Metallizing Booklets

Catalog 42B, recently issued by Metallizing Engineering Co., Inc., 38-14 30th Street, Long Island City 1, N. Y., describes Metco Metallizing Guns, Wires, Surface Preparing Tools and other metallizing accessories in detail. In addition, it tells how sprayed metal coatings are saving critical materials and manpower in the production and maintenance of war-needed parts and equipment.

The above company is also offering a limited number of copies of its 80-page Metallizing Handbook to present and potential users of the metallizing process. Profusely illustrated with photographs and diagrams, this Handbook covers every phase of the process, from surface preparation to spraying techniques and the finishing of sprayed metal coatings. Price $1.00 post paid.

Acid Addition Agent

The Enthone Co., Dept. MF, 442 Elm St., New Haven 2, Conn., has issued a new leaflet describing its Acid Addition Agent. Uses and directions for application are included.

Pyrometer Accessory Manual

The Bristol Co., Dept. MF, Waterbury 19, Conn., has recently published a new Pyrometer Accessory Manual, Number P1211, giving engineering data on the selection and installation of thermocouples, protection wells, and lead wire; thermocouple and protection well assemblies, and calibration data and tables.

Other information such as molten metal thermocouples, radiation couples, surface contact couples and special fittings and adapters is also included.

Copies of this manual, can be obtained from the company.

Wax Coatings

In a new descriptive folder, *The Enthone Co.* Dept. MF, 442 Elm St., New Haven 2, Conn., has announced its agency for the line of rust inhibiting wax coatings developed by S. C. Johnson & Son, Inc.

Industrial Finishing

James H. Rhodes & Co., Dept MF, 157 W. Hubbard St., Chicago 10, Ill., has augmented its technical staff of representatives with a new publication devoted to its line of industrial finishing mediums.

This catalog features eight different finishing products which include Felt Wheels and Bobs—used in finishing and polishing of metal parts; Industrial Felts—cut to fit in with special jobs such as protection against heat, light, cold, dust, wind, shock absorption, liquid and gas; Steel Wool—produced in shapes and forms for general maintenance, filters and special uses; Powdered and Lump Pumice—a soft abrasive ideal for polishing copper plates, wood, and plastic parts; Abrasives and Rouges—materials used for grinding, polishing, buffing and lapping of metals, glass and minerals, and Sponges and Chamois—both of which have many industrial applications in addition to general clean-up purposes.

Grinder and Sander Catalogue

A new catalogue which describes, among other items, its swing frame grinder and endless belt sander, is now available from *Jefferson Machine Tool Co.*, Dept. MF, Fourth, Cutter and Sweeney Sts., Cincinnati, O.

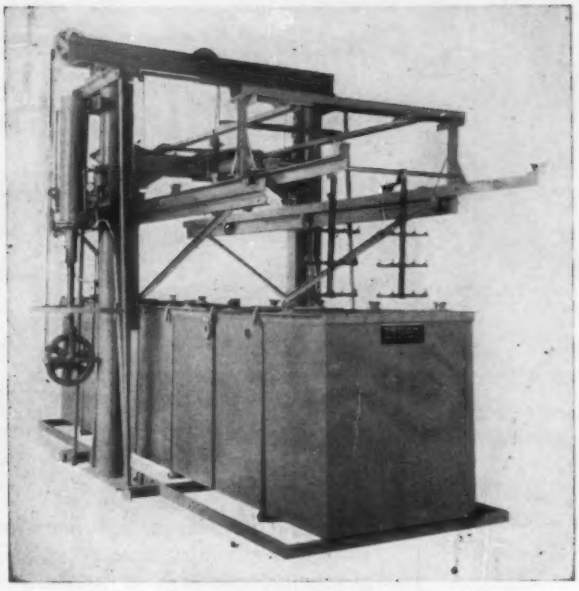
Cleaner

The Enthone Co., Dept. MF, 442 Elm St., New Haven 2, Conn., has published a four-page folder describing its product called "Enthone Cleaner 100" which is claimed to be a fast electrolytic alkali with free rinsing properties. It is also said to have long life and to be stable in hard water.

Heat Measurement

Wheelco Instruments Co., Dept. MF, Harrison & Peoria St., Chicago 7, Ill., has issued Bulletin A2-3, describing its line of Potentiotrols. The bulletin, of eight pages, describes the potentiometer method of heat measurement, and explains the electronic principle employed in the company's instruments to gain instant control in line with the temperatures recorded. Also included is a list of instrument features, four operating diagrams, and a table of potentiotrol scale ranges obtainable with various thermocouples and a photoelectric pickup unit. Copies may be had by addressing the company.

Crown Pick-up Unit



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FOR A SERIES OF OPERATIONS WHERE THE WORK MUST PASS THROUGH SEVERAL TANKS, AS THE CLEANING AND RINSING OPERATIONS, FOR A SEMI-AUTOMATIC PLATING TANK.

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Miccro protective coating materials are manufactured for:

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- Protecting and beautifying plated or natural metal surfaces.
- Resistance to rust and corrosion.
- And numerous other purposes.

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Associations and Societies

Porcelain Enamel Institute

The Porcelain Enamel industry has recently completed plans for development of its old markets and new ones when facilities are released from present war production. The plants of this industry are now largely tied up with war work such as armor plate fabrication and heat treating, making bombs, welding and cutting steel plate, stamping and assembling all kinds of sheet metal containers and even drying eggs. Some plants are producing large quantities of chemicals, refining ores and making tools.

A few are still manufacturing some porcelain enameled products. These plants can be easily reconverted to peace-time items, but the others will need to be completely rebuilt.

The necessity for reconverting in 1944 encouraged the member companies in this industry to provide for a post-war planning committee early in 1943. The work of this committee consisted of five divisions; market research, market development, materials improvement, process development, and factory operations.

On Ocotber 1, 1943, the Market Research Committee presented its findings showing that the market in the seven years after the war might require twice as much porcelain enamel as in the past seven years. It estimated the full potential requirements through 1950 to be 26,860,000 refrigerators, 19,815,000 washing machines, and 21,652,000 cooking ranges.

On November 9th the Market Development Committee presented a plan of promotional work for the industry involving a modest appropriation for advertising and selling literature. This plan was immediately approved and underwritten by the Board of Trustees of the Porcelain Enamel Institute.

Catalogs, bulletins, and other publications will be available for general usage and to assist members, just as soon as materials are released to start manufacturing operations. The industry expects that production will be resumed in 1944 and that 1945 will be a record breaking year.

To meet the need for substantial increase in manufacturing capacity, the Process Development Committee is now considering many methods of improving application of this finish. This report will assist the industry in reconverting the plants to normal production.

This program is being conducted by a committee consisting of R. A. Dadisman, chairman; R. J. Ritchey; B. P. McBride, and C. S. Pearce.

The Porcelain Enamel Institute is the trade association for the industry and represents 53 manufacturers and suppliers.

American Electroplaters' Society

Grand Rapids Branch

The sixth annual educational session and dinner dance of Grand Rapids Branch, A. E. S., is scheduled for January 15th, 1944. The place: The Pantlind Hotel. The time: 2:00 p.m.—educational session; 7:00 p.m.—dinner and floor show; 10:00 p.m.—dancing. The tariff: $3.00.

Presided over by *Cleve Nixon* of the *Ternstedt Manufacturing Co.*, Detroit, Mich., the session will feature the following speakers and subject: *Dr. F. C. Mathers*, Indiana University, Bloomington, Ind.—"Addition Agents in Electroplating"; *W. S. Morrison, Illinois Water Treatment Co.*, Rockford, Ill.—"New Uses of Cation and of Anion Exchange Medium in the Plating Industry"; *Ernest H. Lyons, Jr., The Meaker Co.*, Chicago, Ill.—"Electrogalvanizing of Strip Steel".

Chicago Branch

Chicago Branch, A. E. S., is finishing preparations for its 32nd annual educational session and dinner dance to be held Saturday, January 22nd, 1944 at the Palmer House.

Beginning at 2 p. m., the educational session will present the following talks: "Porous Chromium Plating" by *H. Van der Horst, president, Van der Horst Corp. of America*, Olean, N. Y.; "Heavy Silver Electrodeposits" by *Dr. H. Brown*, research department, *Udylite Corporation*, Detroit, Mich. and "The War Changes Electroplating Specifications" by *W. M. Phillips*, electrochemistry department, research laboratories, *General Motors Corporation*, Detroit, Mich.

All tickets reserved at $5.00 each.

Detroit Branch

Detroit Branch, A. E. S., held its seventh annual educational session and dinner dance at the Hotel Statler on Saturday, December 4th. Several hundred attended the educational session and over 850 were present at the banquet.

Los Angeles Branch

W. P. Wallace, metallurgist for the *Columbia Steel Co.*, delivered a timely and interesting talk on the "Manufacture of Steel for Electro-Deposition" at the educational session of the December 13 meeting of Los Angeles Branch of the A.E.S.

The speaker pointed out that while in the past it may have been considered sufficient to deposit any kind of plate on any kind of metal, such practice followed an entirely false principle. Today, he declared, steelmakers produce steel designed specifically for use in electroplated parts, employing heavy melting scrap in the production of such steel, the rolling and pouring technique for which must be precise so that seams, laminations and other undesirable conditions may be eliminated.

He explained the process of making steel for use in plating shop work. When the steel reaches the average plating shop, he declared, it has already been shaped into forms and parts.

The greater portion of Mr. Wallace's talk was in the form of answers to written questions which had been submitted to him prior to the meeting:

To the question of how to remove scale from spring steel and heat treated parts without causing hydrogen embrittlement, Mr. Wallace stated that the use of an inhibitor was indicated. He warned, however, that an inhibitor would increase the pickling time, but declared the time could be cut down by using the right amount of inhibitor. In this connection, several plant operators volunteered the information that better results could be obtained by adding the inhibitor in parts every hour instead of dumping it all in at one time.

Mr. Wallace advised that the nickel, chrome, molydbenum and copper in the original steel have no affect on the plate as those metals are dissolved in the iron and do not take any action on the plate. Chromium, he said, is the only one of the four which can affect the plating solution.

"Blistering and spotting," said Mr. Wallace, "are due mainly to the operator's own actions. For instance, when acid is added to a plating solution, not all the acid goes into the reaction. Therefore, the pH value of the solution is what determines whether you will get a good or bad job of plating."

The second speaker was *Carl Stentz*, sales engineer of the *Latex Seamless Products Co.*, who delivered a talk on the rubber situation, with reference to automobile tires as well as to plating shop rubber requirements and how they have been affected by the change-over to synthetic linings for solution tanks and other purposes.

Mr. Stentz said it had taken 60 years to get rubber up to par for plating shops. When the war came, he declared, all the experiences of 60 years went overboard and we had to start anew on synthetic problems. We are now in the third year of synthetic rubber, he pointed out.

Mr. Stentz described the properties of various synthetic rubber formulas which have come to the fore in the past few years. He referred to Buna S as the formula nearest to natural rubber, and to Koroseal as the synthetic rubber which probably will play an important part in plating room work in the future because of its resistance to acid and its general adaptability for plating shop uses.

The speaker declared that the situation insofar as natural rubber is concerned is still gloomy, but that the synthetic situation is very promising. By early 1944, he predicted, all synthetic rubber plants should be in production, providing a yield for 1944 of at least 850,000 long tons, of which 750,000 will be of Buna S.

Mr. Stentz stated that it has been found that neoprene gives a less efficient bond to the metal than can be obtained with natural rubber tank linings. He expressed the opinion, however, that such rapid strides are being made in development of tank linings from neoprene as well as Buna S that synthetic rubber tank linings eventually should be better than the natural rubber linings of the pre-war period.

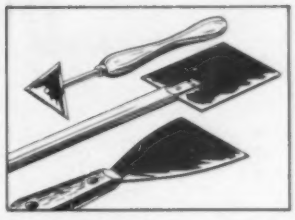
Emmette Holman of *Turco Products, Inc.*, presided at the business session which followed the educational program. Thirteen guests were introduced by Sergeant-at-Arms *Stanley Rynkofs*, including: *Robert Lawson, Cadmium and Nickel Plating Co.; Jack Hodges, Latex Seamless Products Co.; Howard Woodward, Hard Chrome Engineering Co.; Clifford P. Graham* and *Roy Lodstatter* of the same firm; *Guy Pearson, Cadmium and Nickel Plating Co.; Ray Weaver* and

Beryllium Copper Bites Into Steel

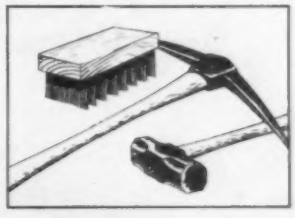
It is an old saying that when a dog bites a man it is not news, but when a man bites a dog it is news. That being the case, it is certainly news when copper bites into steel. Copper is, of course, one of the softer metals but when 2 percent beryllium is added to copper, its characteristics are changed. The alloy is heat treatable which explains the remarkable strength and hardness. Hit a chisel made of Beryllium Copper with a hammer and it will bite into steel without dulling the edge. Tools made of Beryllium Copper are non-sparking and therefore are used in ordnance plants, oil refineries and other places where explosions may occur from sparks off steel tools. Tensile strength as high as 200,000 lbs. psi can be obtained with Beryllium Copper; hence, it is used for many applications where resistance to high loading and impact fatigue are important, such as airplane motor bushings. Most of the critical springs and diaphragms used in aviation, Navy and Signal Corps instruments are made of Beryllium Copper because of its reliability as a spring material.

We hope this has proved interesting and useful to you just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for victory.

You can get complete information about these tools from the Beryllium Corporation, Reading, Pennsylvania.



Man has tried for ages to rediscover the art of hardening copper. Today this can be done by adding to copper a small percentage of beryllium.



Not only does it produce an alloy harder than tempered steel, but one that does not produce sparks, an essential when working near highly combustible materials.

X-64

Tivit Products Co., 8024 So. Vermont Ave.,

Coming Educational Sessions and Banquets

of the

American Electroplaters' Society

Grand Rapids Branch

Sixth Annual Educational Session and Dinner Dance

JANUARY 15, 1944

at the

PANTLIND HOTEL

Educational Session 2 P.M.
Dinner and Floor Show 7 P.M.
Dancing 10 P.M.

Chicago Branch

Thirty-second Annual Educational Session and Dinner Dance

JANUARY 22, 1944

at the

PALMER HOUSE

Educational Session 2 P.M.
Dinner and Dancing in the Evening

Baltimore-Washington Branch

Annual Educational Session and Dinner Dance

FEBRUARY 5, 1944

at the

LEE SHERATON HOTEL

15th and L Sts., N.W., Washington, D. C.

S. F. Peaclin, General Electric Co., Ontario, Calif.; *H. S. Young, Douglas Aircraft Co.; E. P. Twegle, Douglas Aircraft Co.; K. O. Munford, National Supply Co.; J. M. Clark, Bendix Aviation, Inc.; Ted Weisser, Thompson Products Co.*

Howard Woodward of the *Hard Chrome Engineering Co.*, Los Angeles, was accepted into associate membership. As part of a membership building plan, the secretary was instructed to mail to all guests present at each meeting a notice of the next forthcoming meeting.

Marcus Rynkofs, chairman of a committee appointed at the November meeting to investigate the advisability of holding an annual educational session in 1944, presented his report at the December meeting.

The committee recommended that the branch hold an annual educational session; that the date be Saturday, March 18, 1944; and that the site be the Los Angeles Breakfast Club, where the successful sessions of 1941 and 1942 were held. Mr. Rynkofs reported that the committee was of the opinion that the branch could continue its practice of holding such sessions with entire propriety. The committee found that ample support for the project from the plating and allied industries of Southern California could be anticipated. The branch voted unanimously to accept the committee's recommendation for holding the session on the date and at the place designated. Whether or not it will be an all-day or a half-day business session, followed by the annual banquet in the evening, was left to the discretion of the committee and will depend upon the availability and number of speakers.

Assisting Mr. Rynkofs on the arrangements committee are *Clarence Thornton, Don Bedwell, Frank Bunker, Carroll McLaren, Ernest Lamoreaux, Earl Coffin, Stanley Rynkofs, John Merigold, Frank Wells* and *Emmette Holman*, the latter as ex-officio member.

News from California
By FRED A. HERR

Metal finishing operations will be conducted in the former No. 1 plant of the *Hallenscheid-McDonald Co.*, 1344 West Washington Blvd., Los Angeles. Some 24 chrome, nickel, cadmium, zinc and copper tanks formerly used for Hal-Mak plating, have been taken over by the new concern. A 3,000 ampere generator has been added to the hold-over equipment and another generator is on order.

Thomas E. Drummond, formerly with *Lockheed Aircraft Corp.* at Burbank, Calif., general manager of the new company, announced that *William J. Wiseman* has been named superintendent of plating.

Hughes Aircraft Co. of Los Angeles is installing Parkerizing equipment in the plating department of its armament division for use in work on housings for Bell aircraft and various parts of Douglas planes. Five steel tanks have been acquired, including one of 350-gallon and four of 100-gallon capacity. The firm is also installing a spray booth for handling the special lacquer jobs necessary in the Parkerizing process.

Hard Chrome Engineering Co., 1717 East Slauson Ave., Los Angeles, is completing an expansion program in the form of two new buildings, one as a storage room and the other as an addition to the chrome plating shop, at a total cost of $2,000.

Bendix Aviation, Inc., North Hollywood, has completed installation on new 18x18 inch tanks for tin and copper work on small plane parts, according to plating room superintendent *J. C. Williamson*. In the past the firm had let out all its copper work to other plating shops. The company's big stuff consists mainly of hard chrome, cadmium, zinc and Alumilite work.

Supplementing a Parkerizing setup for use on airplane housings in its armament division, which was installed a month ago, *Hughes Aircraft Co.*, Los Angeles, is installing a new paint department, including a spray booth for machine gun housings. Zinc and chrome primer will be sprayed with the new equipment.

The Los Angeles main office of *Turco Products, Inc.*, has announced the opening of a new factory at Houston, Tex., for the manufacture of industrial chemical compounds. *Vachel Poole*, who has been associated with the firm since 1929 and served as district manager of operations in Texas, Oklahoma, Arkansas, Louisiana and Mississippi since 1936, has been named general manager of the new southwestern Texas plant.

James P. ApRoberts, who lately served on the research staff of *Triplett and Barton Laboratories*, Burbank, Calif., has joined the Navy and is stationed at the Naval Training Base, San Diego, Calif.

Tivit Products Co., 8024 So. Vermont Ave., Los Angeles, a subsidiary of *Kelite Products, Inc.*, has opened a new machine shop for fabrication of steel tanks and agitating and filtering equipment for airplanes.

Pacific Tube Co., Los Angeles, is busy producing chrome molybdenum tubes for aircraft frames and motor mounts, carbon steel tubes for condenser or heat exchanger tubes and conductor tubes for ships. The firm's $2,000,000 factory is housed in 17 buildings on a 2½ acre tract. The recent addition of a new bright annealing furnace gives the firm two of the largest such units in the country.

Pacific Tube Co. boasts the nation's second largest range in production of seamless and welded tubes in sizes from ⅜th inch to 4½ inch, at the rate of 100,000 feet of finished tube per day. In the course of production, the tubes are pointed, pickled in a 7% solution of sulphuric acid, rinsed, lubricated, die drawn, cleaned, annealed, passed through a straightener, inspected, trimmed and dipped in rust-preventive solution. The firm has in operation two 25-foot-long, brick-lined pickling tanks.

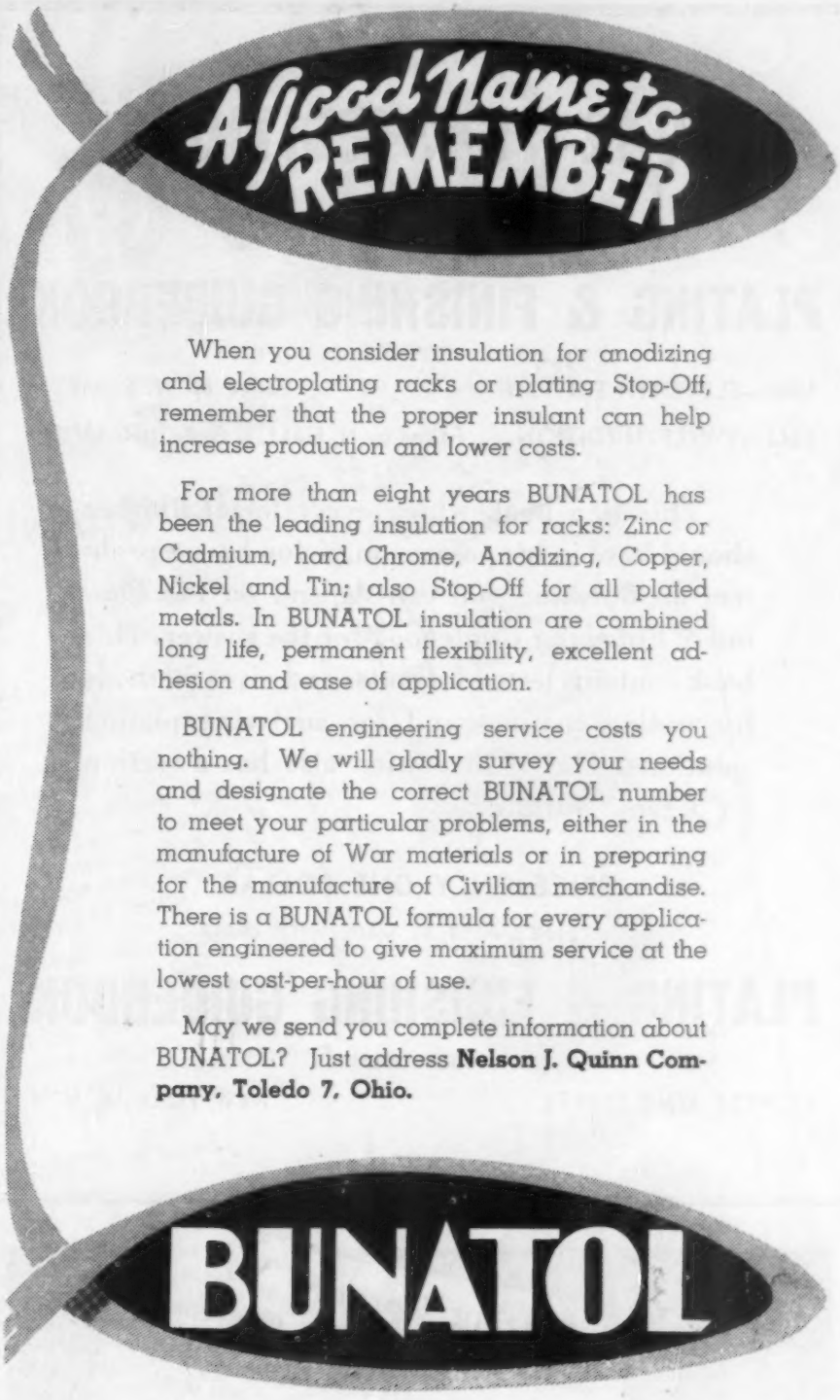
Dr. C. H. Mathewson, national president, and *A. B. Parsons*, national secretary of the American Institute of Mining and Metallurgical Engineers, were guests of honor at the last monthly meeting of Southern California chapter of the Society at the University Club, Los Angeles. Dr. Mathewson delivered an address on "Metals and Alloys of the Future", in which he presented a review of the present supply of metals and alloys and discussed also the use of tungsten, magnesium and molybdenum directly instead of as alloys.

J. B. Ross has resigned from *Linde Air Products Co.* and has joined the staff of *Handy and Harman*, Los Angeles, as brazing engineer for silver brazing alloys and other precious metal products.

F. J. Robbins, 1943-44 chairman of Chicago Chapter of the American Society of Metals, has been appointed technical director of the *Plomb Tool Co.* of Los Angeles.

A talk on "Stainless Electrodes" by *Harold Swertz* of the *Arcos Co.*, Philadelphia, featured the last monthly meeting of Southern California Chapter, American Society for Metals, which was held jointly with the meeting of the American Welding Society at Scully's Cafe, Los Angeles. *V. W. Whitmer*, stainless steel metallurgical engineer of the *Republic Steel Corp.*, Massilon, O., delivered a talk on "Use of Stainless Steel in the Aircraft Industry and in the War Effort".

Ground was broken on December 1 for a $215,000 factory at Los Angeles for *Kinco, Inc.*, a subsidiary of *Kimmont Manufacturing Co.* of Huntington Park, Calif. The all-steel, class-A structure, containing 65,000 square feet of floor area, was scheduled to be ready for occupancy about January 15.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BUNATOL

Samuel Dubman, general manager of *Allied Chemical Co.*, St. Louis, Mo., was in Los Angeles on a business trip in December, accompanied by Mrs. Dubman.

Allied Chemical & Dye Co. of New York has acquired 12 acid spar claims in the Lovelock, Nev., district. The mineral is a source of hydrofluoric acid. Situated in the Black Canyon section of the Lovelock area, the claims were optioned from R. T. Hamilton to *General Chemical Co.*, a subsidiary of Allied Chemical & Dye Co. The acid spar deposit is reported to occur in a limestone capping. An extensive development program and early production are projected by General Chemical Co., including the erection of a concentrating plant if the deposit holds up.

Chrome ore averaging more than $80 per ton is being produced by the Sundown Mining Co. from its properties in the Rock Creek region near Oroville, Calif. The management stated the wallrock runs high in chromic oxide and that the deposit is apparently among the most important ever discovered in California.

1942-1943 EDITIONS
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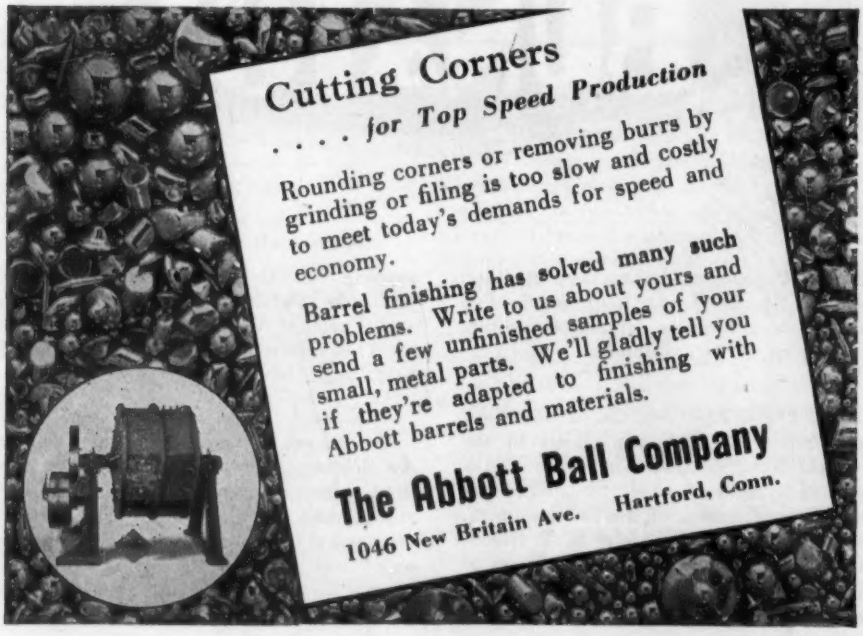
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Courses In Electroplating

The Institute of Electrochemistry a Metallurgy, 59-61 East Fourth St., N York City, will offer specialized courses the field of electroplating and metallu during 1944.

Registration will be held for the Spri courses from January 31st to February inclusive and the first class meeting w occur on February 8th. The followi studies will be offered:

SPRING COURSES

ELECTROPLATING II:

This course is designed to give the el troplater a knowledge of the ways and mea of obtaining better deposits by applying t latest scientific methods of electrochemist to electroplating. One hour of each ev ning will be devoted to a lecture on t theoretical aspects of the subject and t and one half hours will be spent in t laboratory where the student will apply t principles set forth in the lecture. Copp nickel, zinc, cadmium, chromium, silver, a brass will be deposited from aqueous so tions. While plating the above metals, t factors governing the character of the d posit such as current density, temperatu pH, etc. will be noted. Other experimen will include throwing power, single el trode potential, addition agents, resistan of solutions, anodizing and coloring alu num, corrosion tests, etc. After these a complete the students will prepare standa solutions and make analyses of all the i portant constituents of the above plati baths. Tuesday and Wednesday, 7:30-11: P. M. Prerequisite: Electroplating I. or equivalent. Dr. Young, Mr. Klinsevich a Mr. Bundy. Fee: $45.00.

METALLURGY II. (Metallography):

This course is designed to teach the st dent preparation of metallographic sampl for microscopic examination. Various sa ples of different metals and alloys will polished, etched, and examined under t microscope. The detection of faulty all and metals will be stressed. Dr. Young, M Klinsevich and Mr. Bundy. Tuesday a Wednesday, 7:30-11:00 P. M. Fee: $25.

RESEARCH II:

This course is designed to give the pr tical electrochemist a chance to investig problems in his field. One half hour p week is devoted to a conference with t instructor in which the method of att is laid out. The remaining time is spent the laboratory where the student applies knowledge and technique to the solving problems which arise in such an investi tion. Tuesday and Wednesday, 7:00-11: P. M. Dr. Young. Fee: $30.00.

Time payments may be arranged if d sired.

For further information call Dr. C. B. Young, ORchard 4-1778 or FLushing 9-16

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● Now, a super-thin, low-cost coating for zinc and cadmium plated parts that you can treat as rough as you like without danger of its flaking, chipping or damaging its corrosion-resistant qualities. In fact, when Iridite is applied, it is "soaked up" by the plated metal and becomes an integral part of it. That's why you'll never find Iridite "piling up" to alter the dimensions of the part. Even delicately machined and closely articulated parts can be safely protected by Iridite.

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If you manufacture parts that are exposed to weather or to corrosion (except containers for food), you should send, immediately, for full details on the Iridite process. Better still, send us a plated part for Iridite coating, and test it any way you like.

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New Book

Metals & Alloys Data Book. By S. L. Hoyt. Published by Reinhold Publishing Co., 330 West 42nd St., New York, N. Y. 1943. 334 pp. Price: $4.75.

An 11-page chapter deals with hardness tests. The physical properties, compositions, and other information on steels (wrought, cast, and stainless) occupy 190 pages. Nonferrous alloys are covered in 46 pages.

Data on some proprietary commercial alloys ("Hastelloy", "Zamak", "K Monel", etc.) are also given.

Obituary

Murray Charles Beebe

Murray Charles Beebe, electrical and chemical engineer, died on November 28th in New Haven after a month's illness.

In charge of the research department of the Lea Manufacturing Company for the past year and a half, he had been director of research laboratories at the Scovill Manufacturing Company for 16 years.

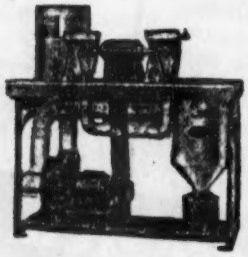
Professor Beebe, formerly head of the electrical engineering department at the University of Wisconsin, developed processes for etching brass and various methods for finishing metals.

He was born in Racine, Wis., on February 25th, 1876. After receiving his B. S. from the University of Wisconsin in 1897 he instructed there for three years. He then started work for George Westinghouse and later served as technical superintendent of the Nernst Lamp Company in Pittsburgh after which he returned to the University of Wisconsin as head of the electrical engineering department.

During World War I, he was employed by Western Electric Company and from 1920 to 1925 was chief engineer of the Wadsworth Watch Case Company of Dayton, Ky.

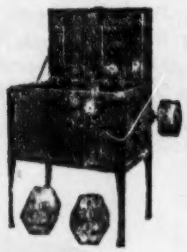
Professor Beebe was a member and examiner of the American Institute of Electrical Engineers, the American Chemical Society and served on the engineering board of the University of Connecticut.

Blower



Polishing Bench

Dryer



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Identification of Rust on Iron and Steel

(*Concluded from page* 11)

Experimental

Tests performed on solvent-cleaned, specially prepared, rusted iron and steel strips using the procedure described gave satisfactory analytical patterns of the rusted surface. Tests made on clean, freshly polished iron strips failed to give a Prussian blue color even upon prolonged development.

The test apparently is specific for iron oxide; attempts to remove sulfide films from copper or lead specimens were unsuccessful. This was attributed to the fine structure and close adherence of the sulfide film in contrast to the rather flaky and loosely held ferric oxide layer.

Literature Cited

(1) Crabtree, Eaton, and Muehler, *J. Phot. Soc. Am.*, 6, 6 (November, 1940).

Suggestions for Selection of Buffing and Polishing Wheels

(*Concluded from page* 13)

or decrease in diameter so that the increase in labor costs rises progressively. Overloading the lathe by the use of too wide a wheel should be avoided; but up to that point there is an economy in using as wide a face as the shape and size of an article permit.

Substantial labor savings are possible through the use of polishing wheels, and, to some extent, buffing wheels, with faces or the whole wheel formed to fit the profile of the objects to be finished. As many as three polishing operations can be combined into one on some articles with shapes permitting this treatment. It is essential that templates, a sample part or detailed drawings accompany orders for these special wheels so that the manufacturer has definite information for their construction.

Subsequent articles will assume that a definite application for a buffing or polishing operation has arisen and that the necessary information on physical dimensions of the wheels required is available. Consideration of the materials used and the construction of various types of wheels, their recommended applications and special features will be outlined for both buffing and polishing wheels.

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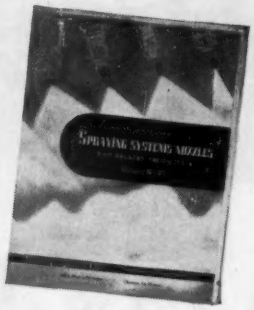

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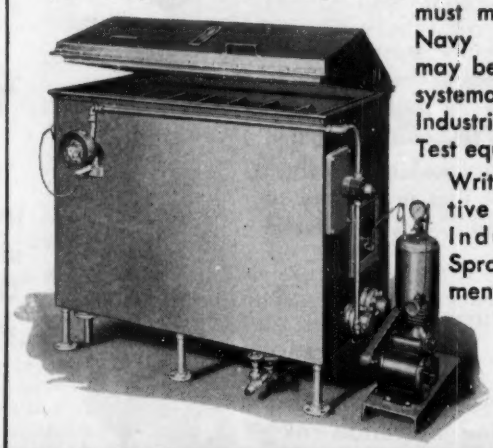

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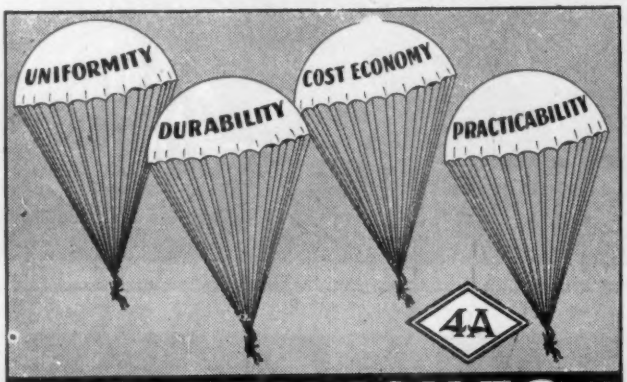

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Business Items

W. Earle Shumway has been appointed sales manager of the western region by *Norton Co.*, Worcester, Mass., succeeding *R. M. Johnson* who was recently appointed general sales manager. Mr. Shumway's territory will extend from just east of the Mississippi River to the west coast, including the Detroit and Chicago warehouse districts.

Mr. Shumway was a member of the 1916 class at Worcester Polytechnic Institute and entered the Research Laboratories of Norton Co. in 1917. From there he went to the sales engineering department and in 1928 was appointed district manager for Connecticut. Since 1932 he has been manager of the Chicago warehouse and sales territories.

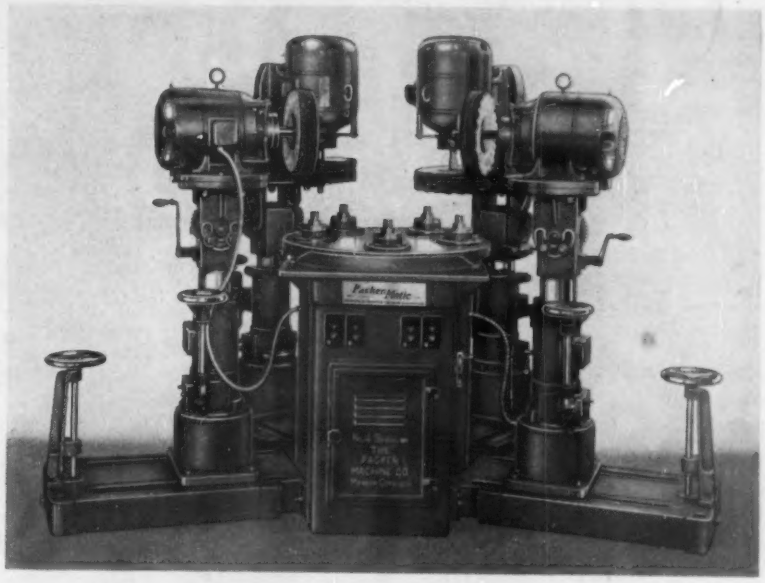
The company's Cleveland warehouse and sales district has been transferred from the western region to the eastern where it comes under *George A. Park*, sales manager of the eastern region. Mr. Park and Mr. Shumway will have their headquarters at Worchester.

Raymond E. Taylor has been appointed Chicago district manager succeeding Mr. Shumway. Mr. Taylor was a member of the class of 1919 at Worcester Polytechnic Institute and has been with the company since 1920, first as methods engineer of the Abrasive Division and later a sales engineer and salesman in the Chicago district. Since 1938 he has been at the Worcester headquarters as business research manager.

Frank H. Foy, formerly with MacDermid, Inc., has announced the formation of his own company which will be known as the *Foy Electro-Chemical Company*, P. O. Box 164, Ansonia, Conn.

The company will manufacture industrial cleaning materials and in addition will supply industrial chemicals and equipment for use in the metal finishing field.

Packer-Matic
Automatic
For Victory



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Pioneer Manufacturers of *Automatic* Polishing and Buffing Machines — Straight Line Conveyors and Rotary Types

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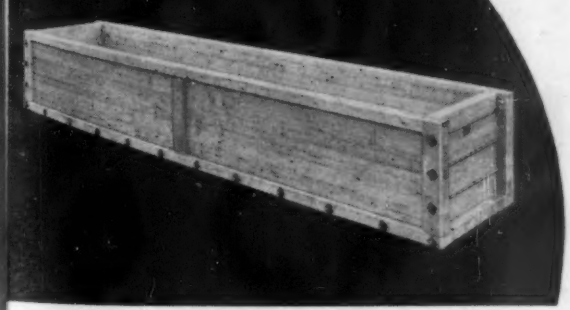


Excellent service on all types of Wood Tanks.

The shortage of metals has increased the demand for wood tanks for plating and pickling service. We can give excellent service on all types of tanks. Send us your inquiries.

Kalamazoo TANK & SILO CO.
KALAMAZOO - MICHIGAN

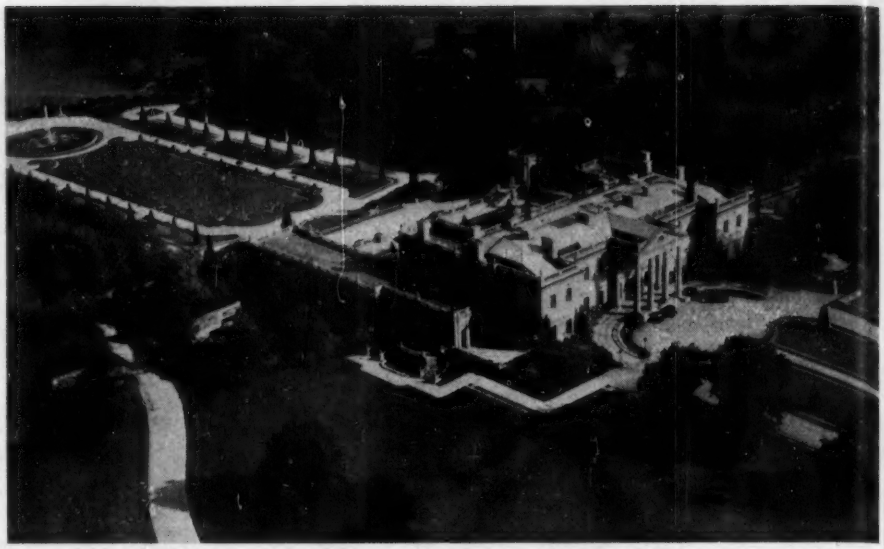
William S. Gray, Jr., was elected a member of the board of directors of the *Phelps Dodge Corp.*, at a recent board meeting. Mr. Gray is president of the Central Hanover Bank and Trust Co., and president of the W. S. Gray Co., as well as being a member of the board of directors of a number of corporations.

B. F. Stauffer, identified with *B. F. Goodrich Co.* for the past 50 years, was elected president and general manager of *American Anode, Inc.*, at the annual meeting of the Akron company held recently. The new president of American Anode assumed his duties January 1.

Stauffer succeeds *Raymond W. Albright*, general manager of American Anode since 1926 who has been named vice-president and general manager of *Distillation Products, Inc.*, of Rochester, N. Y.

Joining B. F. Goodrich in 1893 in the bicycle tire department, Stauffer has served his company in various production and sales capacities and was assistant general manager of the industrial products sales division at the time of his selection to head American Anode.

He was hired by the late B. G. Work, then works manager and later president, and for a time served Mr. Work as a messenger and clerk as well as relieving the regular company telegraph operator. He was attending night school when he was made chief clerk in the company's sundries department.



Pictured above are the Whitemarsh Laboratories, the former residence of the late E. T. Stotesbury, recently purchased by Pennsylvania Salt Manufacturing Co., Philadelphia.

On January 3rd, 1944, *L & R Manufacturing Co.* of Arlington, N. J., opened its Chicago sales office under the supervision of *John Willard Denniston*, western sales manager.

The office is located in the Pittsfield Building, Suite 834, 55 E. Washington Street, Chicago, Ill. Mr. Denniston will cover the states of Minnesota, Iowa, Missouri, Kentucky, Wisconsin, Illinois, Michigan, West Virginia, Indiana, Ohio, Western Pennsylvania and Tennessee.

Mr. Denniston was formerly in charge of sales for the New England area, although he has done some traveling in the midwest. He has been with L & R for several years and has a good background of experience in precision cleaning of small, highly vulnerable parts.

Otto E. Zahn has been appointed assistant works manager of *American Foundry Equipment Co.*, Mishawaka, Ind., with general supervision over all manufacturing operations.

Brushing Nuglu

THE ABRASIVES AND NUGLU MIXED

For recoating abrasive belts and bands.

Will last 3 to 7 times longer than a new belt or band.

We can recoat them for you on our belt recoating machine.

Capacity 1000 belts daily.

•

J. J. SIEFEN CO.
DETROIT

Elmer F. Stephan, formerly an assistant professor of chemistry of the faculty of St. Bonaventure College, St. Bonaventure, N. Y., has been appointed to the research staff of Battelle Memorial Institute, Columbus, O., where he will be engaged in studies of industrial problems in the field of electrochemistry.

Mr. Stephan holds Bachelor of Science and Master of Science degrees in chemistry from St. Bonaventure College. He is a member of the American Chemical Society and the New York Academy of Science.

The A.B.C. Chemical Co. has announced the change of their name to *Crane Equipment and Supply Co.* It is the belief that the new name will better identify the products that the firm now distributes and will fit in better with the post-war plans of the company.

The Crane Equipment and Supply Co. is now New England distributor for the *Mechanical Process Co.* of South Orange, N. J., manufacturers of D'Oiler manual and automatic degreasing machines. They also distribute *Westvaco Chlorine Products Corp.* TROMEX degreasing solvent. They are also New England sales and service representatives for the *Solvents Recovery Service Inc.* of Newark, N. J., whose entire business is devoted to the recovery of lacquer thinners, wash and stripping solvents, and the recovering of trichlorethylene from the sludge of degreasing machines. They also distribute *Rackote* plating rack insulations and stop-off lacquers. Oil refining and purifying equipment, storage and mixing equipment for corrosive chemicals, synthetic tank linings and corrosive resistant paint are among other products distributed by the company.

At a meeting of the board of directors of the *Pittsburgh Plate Glass Co.* in New York, December 15, the following changes in executive personnel were approved, to become effective as of January 1, 1944: *Clarence M. Brown* has resigned as chairman of the board of directors, but will remain active on the executive committee, on the board, and as chairman of the finance committee. *Harry S. Wherrett*, now vice chairman, will become chairman of the board. *Robert L. Clause*, now president, will become vice chairman of the board, and *Harry B. Higgins*, now executive vice president, will become president.

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If you do pickling of iron and steel, Enthone Acid Addition Agent is needed by you to:

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—will speed up Production in your plant during '44

PERMAG Compounds have been doing a thorough metal cleaning job in hundreds of war plants—is ready to help step up your output, keep down rejects and make '44 a record year.

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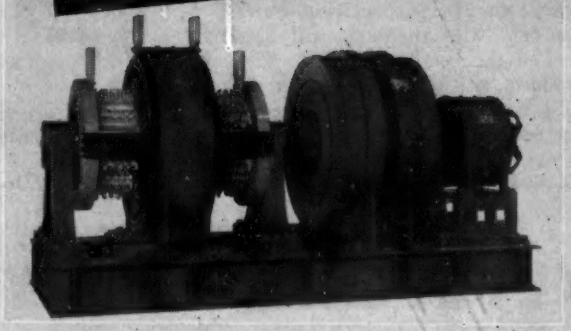
182

COLUMBIA **MOTOR GENERATORS**
for Electroplating and other Electrolytic Processes



Columbia Generators embody every feature essential for dependable, 24-hour operation. They are built for electroplating service in sizes of 6 to 20 volts, 500 to 20,000 amperes, for anodic treatment of aluminum in sizes of 40, 50, and 60 volts, 500 to 3,000 amperes. Columbia Generators for other electrolytic processes range from ½ to 250 KW, 100 to 40,000 amperes, 6 to 60 volts.
Prompt shipment can be made on any type and size. Write for full information.

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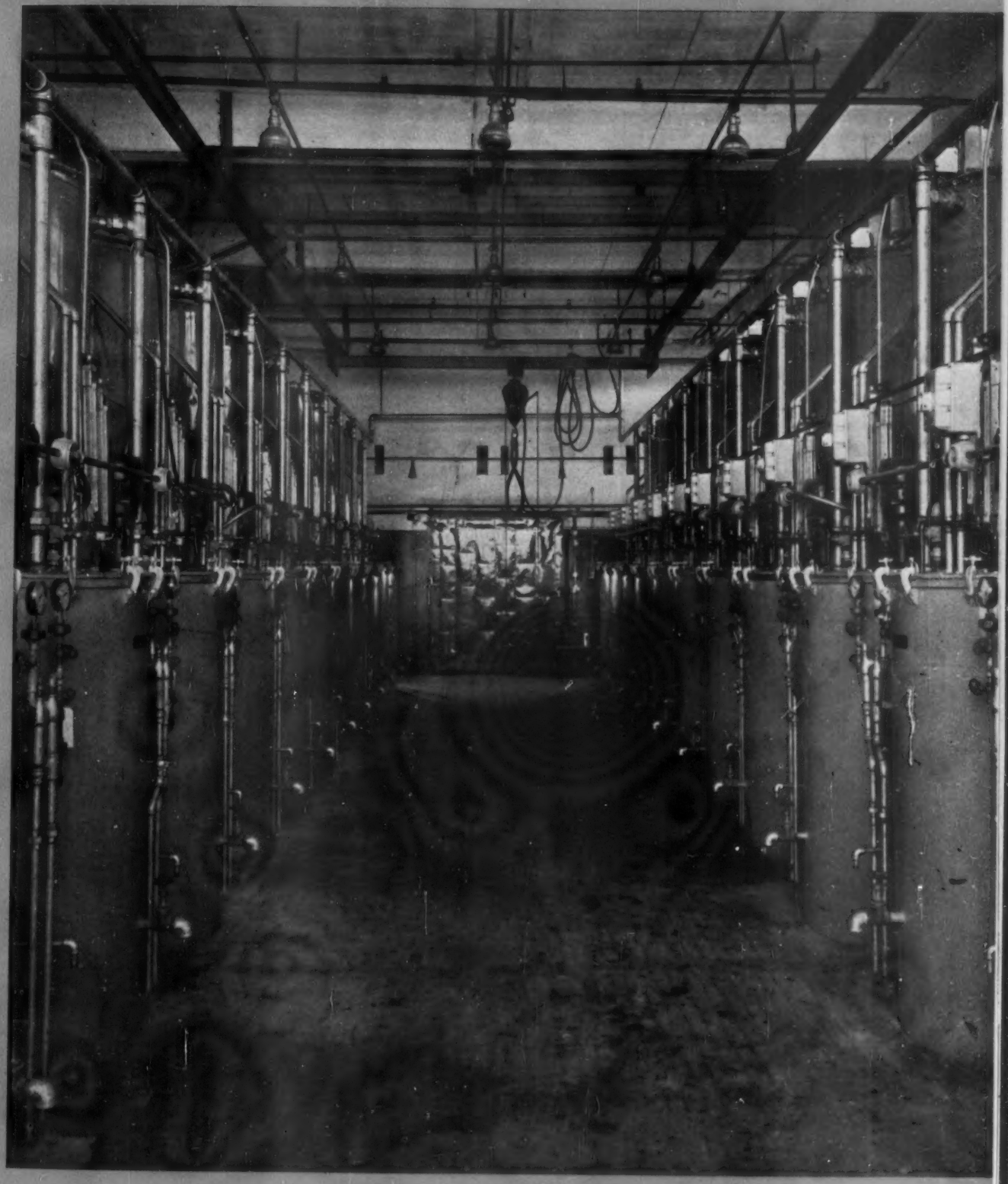
JANUARY, 1944

ORGANIC FINISHING

SECTION OF METAL FINISHING



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Zapon's famed Duranite heat reactive finishes and their component materials are doing a vital war job. There have been little or none available for a long time for any other than military use. But they'll get a royal welcome when they once more return to civilian use—and it won't take long to get them ready.

Many have been improved through experience gained in war work. New Duranites have been designed as need arose for special new metal finishes. Old production schedules have been speeded, new ones worked out. Valuable progress and improvements can be reported in Zapon finishes.

Versatility, strength, toughness, 'mileage,' a wide variety of production schedules, prices geared to competitive costs of products—these highlights of Zapon's Duranites, plus much more that has been added, will be at the finishers' command when the Duranites demobilize.

Duranite—Trade Mark

Buy War Bonds

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Founded January, 1903
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ORGANIC FINISHING

SECTION OF METAL FINISHING

JANUARY, 1944

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Cover Photograph

Complete circulating system. Material is pumped from bottom tank to one above and then circulated to various lines throughout factory. *Courtesy Binks Manufacturing Co., Chicago, Ill.*

The Past Year and The Future

The year 1943 was not an ordinary one for the finishing industry. First, it was probably the largest year that the industry has seen in its entire history. When the record is compiled, it will likely show that more finishing material was used, more equipment operated and more men and women engaged in finishing than in any other year, including the boom years of peace when the war was remote and allocations, restrictions, etc., were only words in the dictionary. Second, the energies and efforts of the industry were devoted almost entirely to what may be called military finishing. Civilian finishing received only little attention. Most material and equipment was produced and used for the sole purpose of applying the best possible finish in the shortest possible time to the myriad of war items which require protective and functional finishes.

At first glance it might appear that 1943 was not a good year for the industry, at least in terms of the future. We think that it was an excellent year. Quite apart from the great amount of finishing equipment and large number of trained finishers—most of which will became available for regular industrial finishing as our war needs decrease—there is the experience which has been gained in faster and better production than we have ever known; in better finish formulations and in newer and better finishing procedures. Unfortunately, much of the information on new and better methods, etc., could not be as openly discussed and widely publicized as in normal times. Much of it, of necessity, was restricted as vital war information. However, the knowledge has been gained and will become available.

Looking ahead we can see the complete return to civilian finishing. It may not be too distant. It will come, of course. It will come more quickly if we bear down hard now on our military finishing.

L. H. LANGDON, *Publisher* • WILLOUGHBY G. SHEANE, *Associate Editor* • T. A. TRUMBOUR, *Business Manager*

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SUPERIOR FINISHES

NEWS FROM WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Alcohol Deficit Predicted It has been predicted that in 1944 there will be a deficit of 50,000,000 gallons of alcohol even though domestic production may reach the total of 590,000,000 gallons.

Butyl Alcohol Prices According to Amendment No. 12 to Maximum Price Regulation No. 37 issued on December 10, 1943 producers of butyl alcohol or acetate who deliver for the account of other producers must use the price ceilings of those for whom they made deliveries.

Castor Oil Restrictions Eased Early improvement is expected in the future quality of paints and varnishes because of the removal of restrictions on the use of castor oil for civilian products. Since castor oil is quick-drying and water resistant it is important in the production of organic protective coatings.

Chrome Ore Deposit Discovered A deposit of chrome ore was recently discovered in the Bird River district of the Province of Manitoba, Canada. This deposit is said to be sufficiently large enough to furnish over 1000 tons of chrome ore a day.

Construction Application Procedure The War Production Board announced on November 18, 1943 that hereafter applicants for construction costing less than $10,000 should send their applications on Form WPB-2570 (formerly PD-220-c) to WPB district offices instead of to Washington. Form WPB-617 (formerly PD-200), which is used for construction work costing more than $10,000 must be filed in Washington and not at the district office.

Drying Oil Situation Improved Because of the record domestic crop of flaxseed, from which linseed is derived, the drying oil situation of the paint and varnish industries is improved.

Ethyl Alcohol Order Eased To reduce the amount of paper work Order M 30 was amended on November 24, 1943. The amended order permits buyers to acquire 7930 gallons of ethyl alcohol in any calendar quarter without WPB authorization. Previously, the limit was 3500 gallons.

Glass Paint Container Amendment No. 1 to Schedule E of Limitation Order L-103, as amended on November 20, 1943 adds to the list of permanent standard glass paint containers, and shown as Exhibit 12-96 in the basic order, a one gallon container.

Glass Container Restriction Must Continue Hugh A. Carrol, Chief of the WPB Glass Container and Closure Section, issued a statement on November 20, 1943 which revealed that at a recent meeting of the WPB Glass Containers Manufacturing Industry Advisory Committee it was the consensus of those present that the restrictions on the acceptance of new glass containers by commercial users must be continued through 1944.

Industrial Paint Price Exemption Amendment No. 37 to Revised Supplementary Regulation No. 1 to the General Maximum Price Regulation issued on December 8, 1943 provides that the "sales by manufacturers of industrial paints that were not sold during or before March, 1942, have been exempted from price control, provided the total sale of any one such paint does not exceed $1,000." The term 'industrial paint' is defined in the amendment as "a protective coating for industrial equipment, military equipment, and articles manufactured primarily for resale." This definition does not include protective coatings known as "shelf goods paints" and "trade sales."

More Information To Be Made Available Donald M. Nelson, chairman of the WPB, announced on November 29, 1943 that a considerable amount of statistical material on industry which heretofore was treated as restricted war information will soon be made available to business for planning present and future operations. This material will be based on reports and studies made by the War Production Board, the Census Bureau, Bureau of Mines, and other Government bureaus and departments. In making this announcement Chairman Nelson cautioned that "No one should read into the change of policy any implication that the war is as good as won, and that industry can now diffuse its thinking and energy in war production. Our effort must not be relaxed in the least."

New Army Unit Created The Army Contract Termination Branch which operates under Procurement Regulation No. 15, and the Army Redistribution and Salvage Branch which operates under Procurement Regulation No. 7 were on December 1, 1943 brought together into a new division known as the Readjustment Division of the War Department.

Oiticica Oil Production In Brazil The United States Department of Commerce has revealed that the production of oiticica oil in the state of Piaul, Brazil, for the season ending April 1944 is expected to be 1,500 metric tons. And the state of Ceara is expected to yield an additional 2,000 tons of seeds. This total of 3,500 metric tons is higher than the production in 1943 and 1942. And yet this amount is relatively small when compared with the bumper crop of 17,000 metric tons in 1941.

Paint Price Control Exemption The OPA issued Amendment No. 37 to Revised Supplementary Regulation No. 1 to the General Maximum Price Regulation on December 11, 1943 for the purpose of making clear that the "sales by manufacturers of industrial paints that were not sold during or before March, 1942, have been exempted from price control provided the total sale of any one such paint does not exceed $1000."

Pyrophyllite Price Increase Permitted Amendment No. 20 to Order No. A-1 under Maximum Price Regulation No. 188 was issued on December 8, 1943 by the Office of Price Administration to provide for "a 40 cents-per-ton increase in maximum prices to permit essential production of pyrophyllite" which is used as a pigment extender.

Rosin and Turpentine Production In India For the quarter ending June 30, 1943, the production of rosin in India amounted to 1,058 long tons, and the production of turpentine output amounted to 233 long tons. On June 30, 1943 the stockpile of India amounted to 1,565 long tons of rosin, and 396 long tons of turpentine.

Rosin Prices Increased In U. K. Recently the price of rosin was increased two shillings, in all grades, in the United Kingdom. This is the second change since the establishment of price control in the United Kingdom in October 1941. The first change took place in June 1943 when American gum rosin prices were increased by ten shillings per hundredweight and those of wood rosin from two to eight shillings per hundredweight. The prices of turpentine remain at 87 shillings per hundredweight.

Titanium Dioxide Restrictions According to Conservation Order M-353 issued on December 6, 1943 preference ratings below AA-2 for pure titanium dioxide, used as a pigment in the production of paint, were voided except on military orders.

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"One World"—says Mr. Wilkie . . . and a changed world. One vast city. A new world . . . conjured up by chemists . . . today's miracle men. Keep close to chemists and you'll keep contact with progress. They hold the keys of tomorrow.

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Stanley Chemical

Decorating Sheet Metal by Lithography

By STANLEY T. DINGMAN

Linden, N. J.

The author presents a review of the history and accomplishments of the art of printing on metals which will be of interest to everyone engaged in metal protection and decoration by means of finishes and coatings.—*Ed.*

NOW that the war has brought a partial hiatus to the art and industry of tin decorating, it may be interesting and profitable to consider some of the events and factors which have made possible the decorated metal containers which, until a few months ago, were to be seen on most retailers' shelves throughout the world. Today, of course, much tin plate and the materials from which it is made are being used to package war materials for overseas delivery, thus necessitating a change in containers for civilian goods. However, many wartime items such as field rations are still packed in tin containers with lithographed labels and therefore, tin decorating continues but, necessarily, without the color and diversification that was characteristic before the war. Even bottle crowns, the one thing for which no satisfactory alternate has yet been developed, have lost their brilliance and individuality.

These present difficulties are part of the varied history of metal decoration which has shown a continuous and consistent improvement in methods and in the final results, in spite of the numerous difficulties which have beset the industry in the less than one hundred years of its existence.

History of Lithography

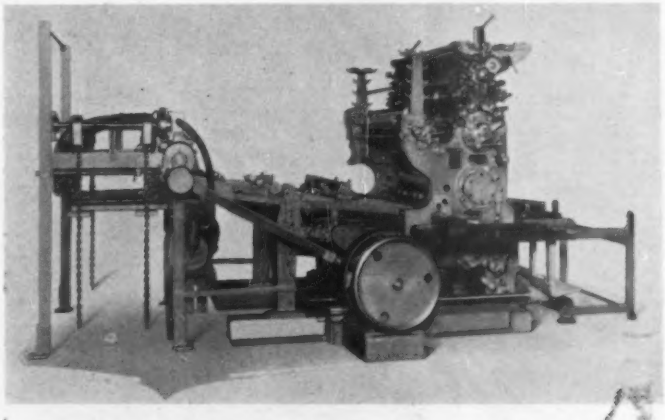
The beginnings of lithography were laid down, as is well known, by the discoveries of Senefelder about 1796. It was at this time that the first crude methods for the direct reproduction of designs came to light. Like most other momentous discoveries these things were found out through sheer accident. And, like most other accidental discoveries, they were made by a man whose experimental work opened up the path to accidental discovery. In other words, if Senefelder had not been trying to solve a printing problem, he would never have found those answers which provided the basis for an entirely new type of printing.

It has been said that the actual discovery of the lithographic process was due to the domineering and demanding temperament of Senefelder's mother, who insisted one day that he immediately write down a list of laundry items being given to the laundress. Having no paper or pencil handy he picked up a home-made stick of ink which was actually a form of grease pencil. With this he jotted down the items on a slab of limestone.

There were reasons, of course, why Alois Senefelder had the grease pencil and the limestone slab handy. He was trying even then to find an inexpensive method of printing that would eliminate the cost of type and the labor of typesetting—not because he was a printer but because he aspired to be a poet and playwright. As a matter of fact, before this time he had already written a successful play that sold in fairly extensive quantities but practically all the money he received from the sale of the play was used to pay the printer's bill. Since he felt, naturally enough, that he would like to have a better percentage of the profit for himself, he set about to see if there were some other way to reproduce the material he had written and intended to write in the future.

His experiments became so engrossing that Senefelder forgot his other aspirations just as the world has forgotten the few literary contributions he made. In spite of the success he made in founding a new and virile graphic art, he never did succeed in his primary aim—the elimination of the need for typesetting for satisfactory reproduction of the written word. This failure was undoubtedly rather distressing to him as he had spent years in learning how to write backward on his composing stone. All of this diligently acquired skill was made useless when he found, one day, that he could transfer a positive design from paper to a negative design on his stone, which in turn would give him a positive print on subsequent sheets of paper.

It was in this transfer process that Senefelder discovered the principles of shallow etching and these principles were the ones that subsequently made possible the use of zinc and aluminum plates and the development of the photo-offset process—a process which has been responsible for making possible the accurate and multiple reproduction of a design. This is of especial importance in the decorating of tin containers, bottle crowns and similar articles when the design must be repeated hundreds of times over a comparatively small area.



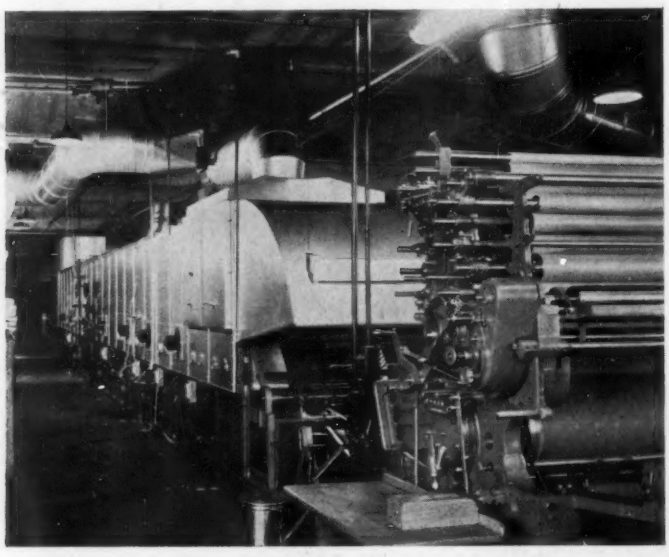
Modern high-speed rotary lithographic press for decorating sheet metal.

While it is true that the modern art of tin decorating owes its existence to Senefelder's experiments to find a better way of printing on paper, this latter branch of the graphic arts industry owes almost as much to the metal printing branch for a refinement of the lithographic process. This refinement is offset printing which lent impetus to the development of the high-speed rotary press and the growth of the entire lithographic printing industry. As to the development of offset printing, Broun, in his *Offset Lithography* has this to say: "As a matter of fact, tin printers were the first offset lithographers, and while it is a well established fact that Ira Rubell, the acknowledged discoverer of the offset process as applied to paper, never saw a tin-decorating press, the fact remains that long before he applied his process to printing on paper, the tin decorators of the country were printing on tin in exactly the same manner as he proposed to print on paper."

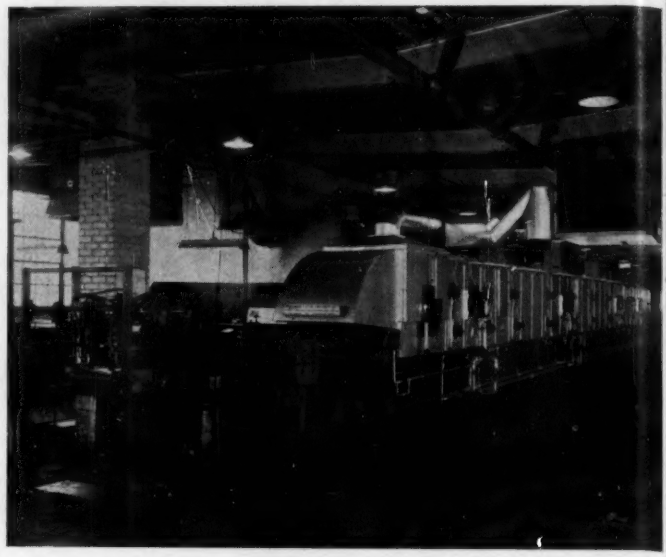
There is some question as to just when the tin decorating process was first originated but there were some fairly well established metal decorating plants in France before 1870 and in 1872. A plant was set up in England by a man who had studied the process in France. From these small beginnings with designs laboriously drawn by hand and the printing down on slow flat-bed presses, the art has progressed rapidly in the seventy years of its existence and, while it is now in a high state of development, it is by no means stationary for every day new refinements are being worked out.

The Lithographic Principle

As is well known, the lithographic process is based on the simple fact that oil and water will not mix. However, it was only trial and error experimentation that revealed to Senefelder just how this scientific fact could be put to work in a printing process. He found that after the design or writing was laid down on the stone with a grease pencil, and the stone then moistened with water, the oily inks would deposit only on the greasy writing, which, of course, repelled the water. Present day commercial lithography and sheet metal decorating follow these same principles and differ only in the refinements which have made higher speeds and better results possible. Whether the design is laid down by hand or photographically on stone or zinc or aluminum plates, the antagonism between grease and water still forms the basis on which the process depends. Regardless of the method by which the design is laid down or the type of plate on which it is laid, there is left a water-repellent, grease-absorbing pattern. A water fountain continually moistens the plate so that the ink from the inking rollers is picked up only by the greasy design and then transferred to the surface to be decorated.



Lithographic press and sheet baking oven.



Roller coating machine and oven for applying and baking finishes on sheet metal.

Modern Progress

It was, of course, the advent of the rotary press which marked the greatest advance in metal decorating and when it thus became possible to print at high speeds, the necessary auxiliary equipment such as sheet feeders and baking ovens were improved to keep pace with the new-found speed of the industry. The spot coater, too, which made possible the use of background of finishing material instead of a printed one opened up new possibilities in decorative design.

The newer inks and varnishes growing out of the research chemists' activities are providing better working materials. Some of the advance that has taken place in the production of inks are suggested by the great number of materials which now go into their making. The first inks were, usually, a pigment in a heavily bodied oil, such as linseed oil, prepared by the unusual procedure of heating the raw oil, igniting it, and then permitting it to burn for a few minutes. Sometimes pieces of stale bread or peeled onions were stirred in the oil until they turned brown on the premise that this treatment would remove the greasiness of the oil. Today many types of oils and resins, both natural and synthetic, are used in the preparation of printing inks. The list of oils is remarkably familiar to paint and varnish compounders. China wood (tung) oil, oiticica, perilla, dehydrated castor oil, soya bean oil, and others all have their place in making certain types of inks. And, as in paint and varnish formulation, oils are combined with resins to achieve certain results. Inks made in this manner dry rapidly and give tack-free films which, when properly prepared, are resistant to abrasion, hot water, etc.

Such developments in one phase of tin decorating are usually accompanied by and aid in advances in other phases. In the composition processes, for instance, there is the precision camera with its step and repeat attachment, the photo-

composing machine, the dot etching process and the deep etch plate, all of which have made possible the use of fewer colors to produce the desired results. One of the more recent developments is in making color prints from a black and white negative. This process is proving well suited to preparing color copy where considerable color correction is necessary in order to give the proper emphasis to fruits, vegetables and other items appearing on the labels of food containers.

There have been some very practical reasons behind the tremendous growth of the metal decorating industry and, while there are some persons who do not always like to think of customer appeal as a practical aspect of business, it is one of the most fundamental reasons, if not the only reason, for decorative containers. The decorative container is more than a lure to get the customer to spend his money. It has proven to be a means of bringing better products to the consumer at less expense. Why? Because metal containers have proved to be the most satisfactory packages for all types of food stuffs as well as other consumer goods. The can is more than just a container. It is a preserver which makes possible the world wide distribution of items that otherwise would be limited to a few localities for only a short time each year. As the decorative container caught the eye of the consumer and persuaded ever increasing numbers of people to try the products, the cost was naturally reduced and so the decorative label is economically justified. The finishes also help the metal container to withstand the ravages of time and the elements and, while plain finishes could satisfy this requirement, they would fail in increasing consumer acceptance which, after all, is the reason-to-be for all products.

Difficulties caused by present-day material shortages confront the manufacturer and user of decorated tin containers and closures, often making necessary shift to other packaging procedures, but it is fair to assume that in spite of the temporary hurt, no permanent set-back will be felt for even now

Lithographic press and roller coating machine in tandem followed by baking oven.

experimentation in newer and better methods is going on. Many phases of metal decorating still admit of room for improvement. Quicker drying inks, lacquers and varnishes are still being sought and when it is realized that the use of synthetic resins is comparatively new, the possibilities of further development are apparent. New photographic methods, color separations, etc. are not beyond the realm of possibility, and the various types of equipment are equally open to improvement. That new developments will take place is evidenced by the fact that metal decorators, since the beginning of the art, have been eager to search out the new and better ways of accomplishing the ideals they have set forth.

What's Ahead in the Finishing Field

By G. KLINKENSTEIN

Vice President and Technical Director, Maas & Waldstein Co., Newark, N. J.

If our war production continues at its present rate for another year, no serious difficulties in supplying the finishing requirements of both essential and non-essential industries need be anticipated.

The manufacturers of finishes have ample capacity to meet the maximum expected demand. They have successfully solved all of the technical problems that have so far been created by war work and, thanks to splendid cooperation on the part of the Allocations Division of the War Production Board, ample supplies of critical materials for finishing vital war products are available.

If our war production should be suddenly cut by, say, 50 percent, as the result of the capitulation of Germany, the manufacturers of finishes will be able to produce lacquers, enamels, varnishes and paints for consumer goods immediately. Many of them will probably continue operations with little change, as the majority of their customers will produce goods very similar to those they are now making. But manufacturers serving certain industries, chiefly like automobile manufacturing, may suffer a temporary loss of business while their customers are re-tooling.

It would probably be impossible to take immediate care of a large and sudden demand for finishes made from critical materials, as the Government is likely to create a stockpile of these materials for emergency purposes and Japan will still prevent access to the best sources for some of them. But it should not take long to accumulate satisfactory supplies of the more important ones.

However, even a long delay in getting back into full production of oldtime finishes will not be serious, for research work by the manufacturers of finishes has developed satisfactory alternates from non-critical materials. Many of these are, in fact, superior to the older materials and will continue in general use after the war.

Thus, when peace comes, better finishes than ever before will be available. Other gains due to wartime developments include more effective use of raw materials and solvents by manufacturers, modernized production machinery, and a greater efficiency in utilizing finishes by users.

Only Extra Performance wins!

FINISHING FACTS

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In the aircraft industry the sealer for woodwork must maintain elastic properties at both ends of the temperature scale—Hot or Cold—while at the same time being sufficiently adhesive to maintain good bond and resist cold-flow under pressure.

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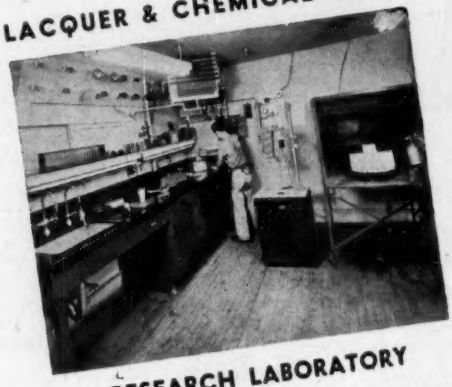

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Developments in Organic Finishing Equipment and Supplies during 1943

For the convenience of readers of ORGANIC FINISHING, selected items of equipment and supplies as reported in ORGANIC FINISHING during the past year are presented here in brief form. Items are listed alphabetically and reference is made to folio number giving more complete details.

Addition Agent

Water soluble addition agent for alkaline cleaning baths. Substituted for 5% to 10% of total alkali normally used. Material has no action on soft metals. Aids in wetting surfaces and emulsifying oils and greases. **64.**

Air Transformer

Heavy-duty, double barreled air transformer with 100 C. F. M. capacity. Permanent filtering and condensing mechanism does not require parts replacement. Fast-acting regulator diaphragms are of reinforced oil-proof synthetic rubber and are chatter-proof. **62.**

Aluminum Treatment

Material and method for treating aluminum to insure adhesion of organic finishes. Minimum of time and no special equipment required. Suitable for treating objects too large for tank immersion. **260.**

Asphalt Paints

Asphalt finishing materials, marine primers and enamels, asphalt solutions for use in equipment paints, etc. **406.**

Brush Cleaner

Non-caustic liquid solvent for cleaning paint brushes and softening and removing dried paint, varnish, etc. Material is ready to use, non-flammable and non-evaporative. After soaking in cleaner, brush is rinsed thoroughly in clean water and dried. **546.**

Chrome Plate Coating

Protective coating for cleaned chrome plated surfaces. Resists climatic and weather conditions and prevents formation of new rust. **761.**

Floor Paint

Special non-slip floor paint for use where there may be slipping hazards. Contains no sand or ground glass. Special granular ingredient provides long-wearing, non-slip surface on all floors. Black, gray and colors. **331.**

Gloss Standards

Calibrated low-gloss standards for use in testing compliance of camouflage materials with specifications. Standards calibrated according to Procedure A of A. S. T. M. Tentative Method D523-41T for specular gloss of paint standards. **761.**

Glossmeter

Meter for measuring the apparent relative reflectance of paints, lacquers, enamels and other finishes. Measurements can be made on any flat surface 2⅛ x 3 inches in size. Results are in terms of I. C. I. Normal Observer and I. C. I. Illuminant C. Operates on 110-120 volt, 60 cycle (controlled frequency) single-phase alternating current. Readings on high and low gloss surfaces can be made without the use of filters or other similar devices. **546.**

Hand Cleaner

Compound designed to remove lacquers, dopes and paints from hands. Material, free from explosive compounds, is worked into paint or lacquer on hands and then rinsed off with water. **620.**

Cleaner and Rust Inhibitor

Liquid metal cleaner containing phosphoric acid, solvents and other ingredients. Supplied in concentrated form. **826.**

Colored Permanent Meter Charts

Plastic recording charts for continuous use on recording instruments using circular charts. Non-flammable, waterproof and resistant to oil, gasoline and grease. **826.**

Deodorant

Concentrated paint odor neutralizer for paint, enamel and varnish. One pint to 100 gallons of finishing material eliminates objectionable odors. **407.**

Floor Masking Material

White, thick liquid for application to floors of finishing rooms to protect them from paint accumulations. Applied by brush, material dries to durable, non-skid surface. Removed from floors by mopping with water. **62.**

Hot Lacquer Equipment

Equipment for application of finishing materials at elevated temperatures. Available with either steam heated or hot water heated units. Equipment includes thermostat for controlling temperature of finishing material. **331.**

Infra-Red Lamps

Carbon filament lamps for infra-red drying and baking of finishing materials. Inside silvered, self-reflector types and bull's-eye, silver types for diffusion and concentration of rays. High efficiency with a minimum of visible light. **478.**

Infra-Red Ovens

Adjustable infra-red ovens for drying and baking organic finishing materials. Constructed to be adjusted to fit the shape of the object. May be used as single units, in end-to-end assemblies, as vertical banks, double banks or complete enclosures. **407.**

Infra-Red Reflectance Standards

Standards showing three levels of infra-red reflectance used in U. S. Army Specification No. 100-12. Metal panels, coated with baked enamel, are permanent and washable. **620.**

Insulating Varnish

Black polymerizing baking varnish for all types of plain, bare, synthetic coated, textile- and glass-covered wire. Applied by dipping or vacuum impregnation and baked in conventional or infra-red ovens. Has high wet and dry dielectric strength and is resistant to water, acids and alkali. **407.**

(*Continued on page* 64)

Patent Abstracts

Coating Composition

U. S. Pat. Reissue 22,402. R. C. Swain and P. Adams, assignors to American Cyanamid Co., Dec. 7, 1943. A coating composition containing polyvinyl acetate methylal and a melamine-formaldehyde resin which has been heated until reacted with an alcohol selected from the group consisting of butyl alcohols and benzyl alcohol, wherein the molal ratio of formaldehyde to melamine is at least about 4:1 and wherein the weight ratio of polyvinyl acetate methylal to melamine resin is at least about 3:2.

Coating Composition

U. S. Pat. 2,328,249. L. Balassa, assignor to E. I. duPont de Nemours & Co., Aug. 31, 1943. A coating composition comprising an oil modified alkyd resin, vermiculite calcined at 600° C. to 750° C., other pigment, solvent, and drier.

Undercoat

U. S. Pat. 2,331,544. L. S. Engle, assignor to Interchemical Corp., Oct. 12, 1943. An undercoat composition consisting of solvents, a flexible, metal-adherent binder, and pigments in the fine, deflocculated, fully-wetted condition of pigment of an enamel, the volume ratio of pigment to binder being large enough to give a dull surface and small enough to permit the binder to incorporate and completely surround each pigment particle.

Pigment Grinding Machine

U. S. Pat. 2,331,929. F. H. Pembroke, Oct. 19, 1943. In a grinding machine, the combination of a pair of grinding rolls adapted to grind pigment or color, plates mounted to press against the ends of said grinding rolls, said plates being adapated to close the open space above the rolls at both ends of the rolls, a shaft on which said plates are carried said shaft extending across above the rolls and means carried on said shaft for yieldingly pressing said plates against the ends of the rolls.

Protective Coating

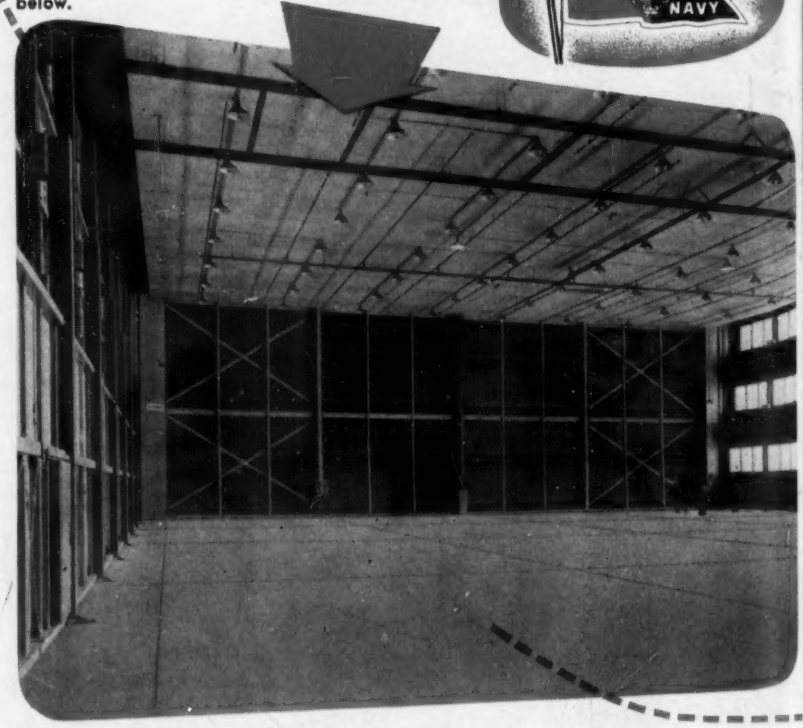
U. S. Pat. 2,332,623. I. C. Clare, assignor to Hercules Powder Co., Oct. 26, 1943. A varnish comprising the reaction product of a polymerized rosin having an acid number of between about 120 and about 165 and a drop melting point between about 90° and about 176° C. and a compound of a metal of group 2 of the periodic table, which metal forms a water-insoluble resinate; and a spirit solvent, said varnish being characterized by water and alkali resistance.

KEEPING UP WITH THE Douglases

ANOTHER GIANT SPRAY BOOTH TO SPEED VICTORY

When engineers at the Douglas Aircraft Company, Inc., wanted a waterwash spray room large enough to house a completely assembled Douglas Army Transport Plane, Binks engineers designed and built the huge installation shown below.

ARMY E NAVY



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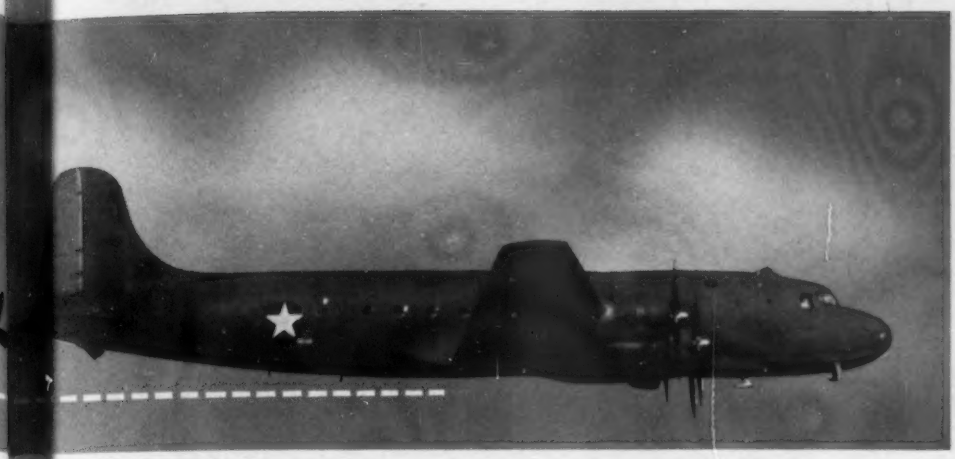
Paint Conditioning

U. S. Pat. 2,333,367. A. C. Eide and H. A. Depew, assignors to American Zinc, Lead & Smelting Co., Nov. 2, 1943. In a method of conditioning paints comprising a liquid vehicle reactive with zinc oxide, the steps of incorporating at least one member of the group consisting of phosphorous pentoxide, arsenic trioxide and arsenic pentoxide in the vehicle, and thereafter adding the zinc oxide component of the paint to said vehicle, whereby the reactivity of said vehicle is reduced before it comes into contact with the pigment.

Paint Composition

U. S. Pat. 2,332,636. W. O. Hose and P. Zurcher, assignors to Patterson-Sargent Co. and Continental Oil Co., Oct. 26, 1943. An acid and alkali-resistant green paint comprising a blend of copper phthalocyanine blue pigment and Hansa yellow in an alkyd resin vehicle.



The men in the background of the photograph reproduced to the left give some idea of the size of a recent Binks installation at a Douglas Aircraft Company plant "somewhere in America." The doors shown on the sides of the room slide up to let great 4-motor Douglas Army Transport planes roll into the booth for painting.

This huge Dynaprecipitor Water Wash Spray Booth has a water curtain totaling 40 feet high and 100 feet long. Air from the room is drawn through this curtain. In this way paint fumes and atomized finishes are washed from the air before it is vented.

The chief satisfaction of designing and building spray painting equipment on this large scale is the knowledge that the work helps to speed the day of victory. Next to that is the valuable experience gained by Binks engineers and designers . . . experience that will make Binks postwar equipment and design services better than ever . . . not only on large installations but right down to the smallest accessory.

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Water Paint

U. S. Pat. 2,334,096. A. M. Howald and M. H. Bigelow, assignors, by mesne assignments to Libbey-Owens-Ford Glass Co., Nov. 2, 1943. A method of preparing a coating composition that comprises preparing a dispersion of a pigment in a substantially neutral solution of a formaldehyde-urea reaction product by means of a dispersing apparatus, evaporating the resulting dispersion to produce a solid product, and bringing said product together with water and a hardening agent capable of acidifying the formaldehyde-urea reaction product to form a self-hardening coating composition comprising a dispersion of the pigment in a solution of the formaldehyde-urea reaction product.

Water Paint

U. S. Pat. 2,334,097. A. M. Howald and J. A. Murray, assignors, by mesne assignments, to Libbey-Owens-Ford Glass Co., Nov. 2, 1943. A stable water-color paste comprising a hardening agent capable of acidifying the composition at ordinary temperatures, a pigment, and a solution of a water-soluble alkoxy-substituted formaldehyde-urea reaction product in a volatile water-soluble organic solvent, said solution containing not more than about one-eighth of its weight of water, and said paste being capable of dilution with water, without substantial precipitation of said reaction product, to form a self-hardening coating composition that produces a washable coating.

Spraying Process

U. S. Pat. 2,334,648. H. P. Ransburg and H. J. Green, assignors to Harper J. Ransburg Co., Nov. 16, 1943. A method of coating articles, comprising the creation of an electrostatic field of definite length and breadth, continuously passing a series of the articles to be coated in spaced relation along the longitudinal center line of said field, and projecting a spray of siccative coating material from one end and exteriorly of said field into the latter roughly parallel and at an acute angle to the said longitudinal center line and with a force insufficient to project the spray beyond the opposite end of the field.

Spray Gun

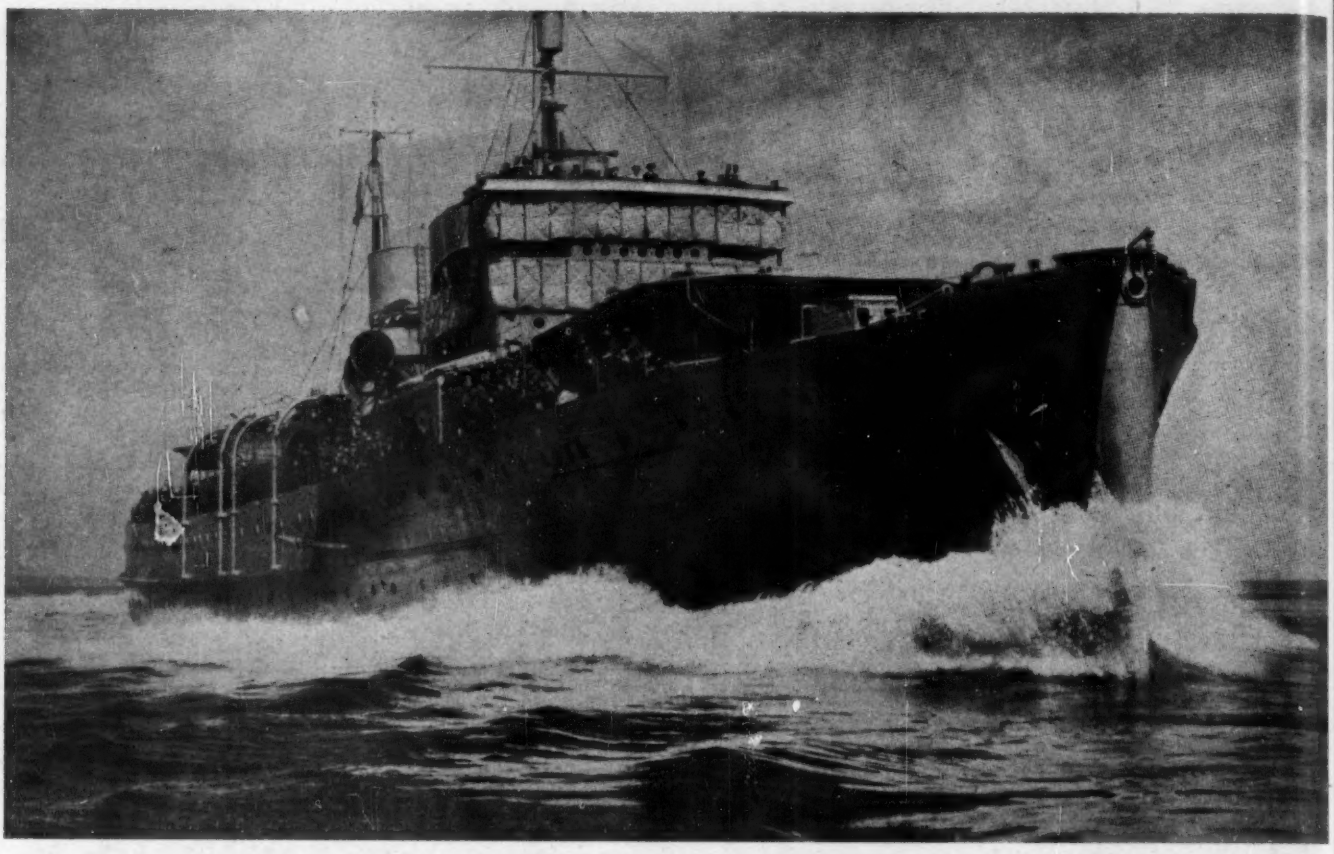
U. S. Pat. 2,335,116. M. E. Hansen, assignor to American Anode Inc., Nov. 23, 1943. Apparatus for spraying a plurality of liquids comprising means for separately discharging concurrently at least two different liquids, means for discharging air or similar material to atomize at least one of the discharged liquids, all said discharge means being arranged in a single spray head within a single spray gun body, and a single control means for operating at least two of the discharges in a predetermined successive order.

Organic Coating

U. S. Pat. 2,335,701. F. B. Root, assignor to Ellis-Foster Co., Nov. 30, 1943. A coating composition comprising a solution containing a condensation product of furfuryl alcohol, urea and formaldehyde in the proportions of from 2 to 4 moles of formaldehyde and substantially 1 mole of furfuryl alcohol per mole of urea, a drying accelerator therefor comprising an acid, a stabilizer comprising a monohydric aliphatic alcohol of less than 5 carbon atoms, and a plasticizer.

Coating Composition

U. S. Pat. 2,335,760. R. T. Hucks, assignor to E. I. duPont de Nemours & Co., Nov. 30, 1943. Coating composition comprising an organic film-forming vehicle containing cellulose nitrate and as a pigment hydrous ferric oxide characterized by an average particle size diameter of about 30 millimicrons and a hiding power of about 30 square feet per gallon at 7% by weight pigment concentration in said vehicle.



Before the war a pleasure cruise liner—now an auxiliary armed cruiser patrolling the sea lanes of the world. Note the plastic armor on deck houses and navigating bridge. Specially formulated compositions protect her hull from the fouling sea-growths that would slow her speed.

Anti-Fouling and Anti-Corrosive Compositions

By J. H. DAVEY

Vice-President and Managing Director, International Paints (Canada) Limited

ONE of the most important developments in scientific paint-making during the past fifty years has been the production of special compositions for protecting the bottoms of ships.

It was no new problem. The Phoenicians used a bituminous composition to prevent fouling, while relics of Roman ships have been found covered with lead plates intended to serve the same purpose. We can go much farther back, as the first recorded instance of a boat having been coated with composition is that of Noah's Ark. The "specification" Noah received contained the words: "Pitch it within and without with pitch."

The day of the wooden ship had its own problem which was solved for a time by the copper sheathing of the bottoms. This system was not only very expensive but failed in its purpose as often as it succeeded. Scientists then evolved a copper anti-fouling paint which is in general use today.

With the passing of the wooden ship and the advent of the iron and then the steel vessel, the day of protection by copper sheathing or copper paint, except for the wooden vessel itself, was over. Copper in any form could not be applied to iron or steel owing to the galvanic and electrolytic action set up between such metals when immersed in a salt solution. In the early days of the iron ship an attempt was made to solve the problem by placing a protective coating of wood over the bottom before fitting the copper sheathing. The wood, however, quickly became impregnated with sea water and corrosive action was at once set up.

Fight Rust and Parasites

Scientists had then to apply themselves to the big problem of producing anti-corrosive and anti-fouling paints, the former as a rust preventive, and the latter to resist marine growth. By a continual process of trial and elimination of various antiseptic and toxic compounds, combined with a close study of the complex chemical reactions, it has been possible to produce a composition that can be applied just like an ordinary paint. This is acted upon by the sea water in such a way as to cause a gradual emission of a poisonous compound, thus killing in the germ stage the animal and vegetable marine life which would otherwise develop on the ship's bottom. The effect of fouling matter on a ship is well known, but the progressive effect has been little understood.

(*Reprinted with permission from Canadian Paint and Varnish Magazine.*")

Everybody knows that when a ship is thoroughly fouled, her speed has fallen off very considerably. What is not always appreciated is the effect of the early days of fouling, when the apparently clean plates of the ship's bottom are covered only with a fine soft slime. Even this slight slime affects the speed of a ship and at this point we should discuss somewhat the origin and explanation of fouling.

The problem of protecting craft of all kinds from the adhesion of marine growth and the attack of organisms is as old, possibly, as the history of shipping itself. In this article, we deal particularly with naval and merchant ships which are subject to the most severe conditions in this respect. Destruction by the boring type of organism, the "Teredo worm," which can eat its way readily through sound oak, is only one of the phases to be dealt with. The ship owner is fully alive to the destructive effects of "grass" and "shell" both as regards deterioration of the hull and loss of speed.

Auxiliary armed cruiser in dry dock for painting and general repairs. Anti-fouling compositions have been used on ship bottoms ever since man first went to sea.

Plankton the Culprit

The surface waters of the sea contain immense numbers of floating microscopic animal and plant life, comprising what is known to biologists as the plankton. The water is so thick with this at times for it to be visible in daytime to the naked eye, while at night the luminous nature of many of the organisms creates the so-called "phosphorescence" of the sea familiar to all. Among the plankton are innumerable young or "larval" forms of such creatures as barnacles, mussels, etc., which when grown up are found attached to objects below the surface. The plankton also contains myriads of spores of the various seaweeds of the sea coasts.

All vessels in the sea are bathed in this soup of living particles, a great many of which will settle, if allowed, on their hulls and grow into the fouling growth so obstructive to speed, destructive to hulls and costly to remove. Generally speaking, the plankton is thickest in coastal waters and comparatively sparse in mid-ocean, while it is densest in harbors and estuaries which are not too full of fresh water, for rivers and harbor effluents tend to bring a rich supply of food on which marine organisms thrive.

The true seaweeds may be divided into three groups: the green, the brown and the red, all of which are represented among fouling growths. They can only grow in the presence of light, the green weeds requiring more light than the brown, and the brown more than the red. Consequently, weed growths on hulls tend to be concentrated toward the water-line, and this applies particularly to the green forms. One of the most familiar fouling growths is the common green ribbon-grass, properly known as "Enteromorpha," and this is usually confined to a belt around the water-line of the ship, its green streamers being rarely found attached more than a foot or so below this line. Other green weeds may extend farther down the sides, while various kinds of brown and red weeds occur at still greater depths. These weeds are generally of feather texture and sometimes form a matted tangle of growth.

Clear Water Promotes Growth

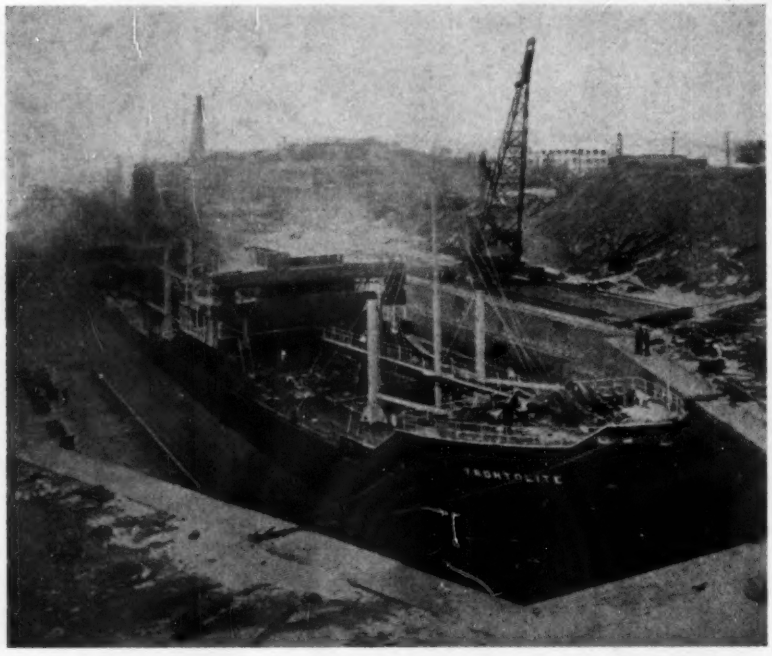
Estuarine harbors, where fresh water is mixed with the salt, are especially favorable to water-line fouling with the streamer-like "Enteromorpha." Waters that are constantly muddy or clouded are unfavorable to the growth of seaweeds on ships, except around the waterline, because the light which is necessary for weed growth is intercepted by the suspended matter in the water.

Ships frequently become coated with a slimy moss-like growth, usually more noticeable on the sides than on the bottom. Such slimes are mostly composed of vegetable growths, often true seaweeds of a low order which form tangled masses of microscopically small threads, and often largely made up of crowded masses of organisms called diatoms, which are microscopic forms related to seaweeds. According to the species of which they are composed, these slimes vary in color. They are commonly green, greenish-brown, brownish-red and even black.

Seaweeds multiply and spread by means of minute spores which are liberated in the water and attach themselves to fresh surfaces. In many cases, these spores are active swimmers which move rapidly by wagging their tails tadpole fashion. They are sensitive to light, swimming toward light of moderate intensity, but away from light of too great brightness. As the time nears for them to settle down, they tend more and more to avoid the light and so are brought into contact with solid objects below the surface on which they can come to rest and grow. They are thus first attracted by light into the upper layers of water and prevented from dispersal in depths whose darkness would be fatal and, secondly, a slight reversal of the reaction brings them safely to a suitable resting place.

Vegetable and Animal

So far, these remarks have applied to the true seaweeds, but, as stated above, there are various forms which, although they are not seaweeds but animals, are commonly classed as "grass"



Typical of the great tankers that carry the oil with which to run the weapons of war is the 9,600-ton S. S. Trontolite, shown here in dry dock for painting and overhaul at St. John, N. B. Marine painting demands tremendous quantities of paint materials. Requirements for an ocean-going 15,000-ton tanker are 438 gallons of protective coatings every eight months. This includes 200 gal. anti-corrosive, 150-gal. anti-fouling, 38 gal. boot topping and 50 gal. top side black.

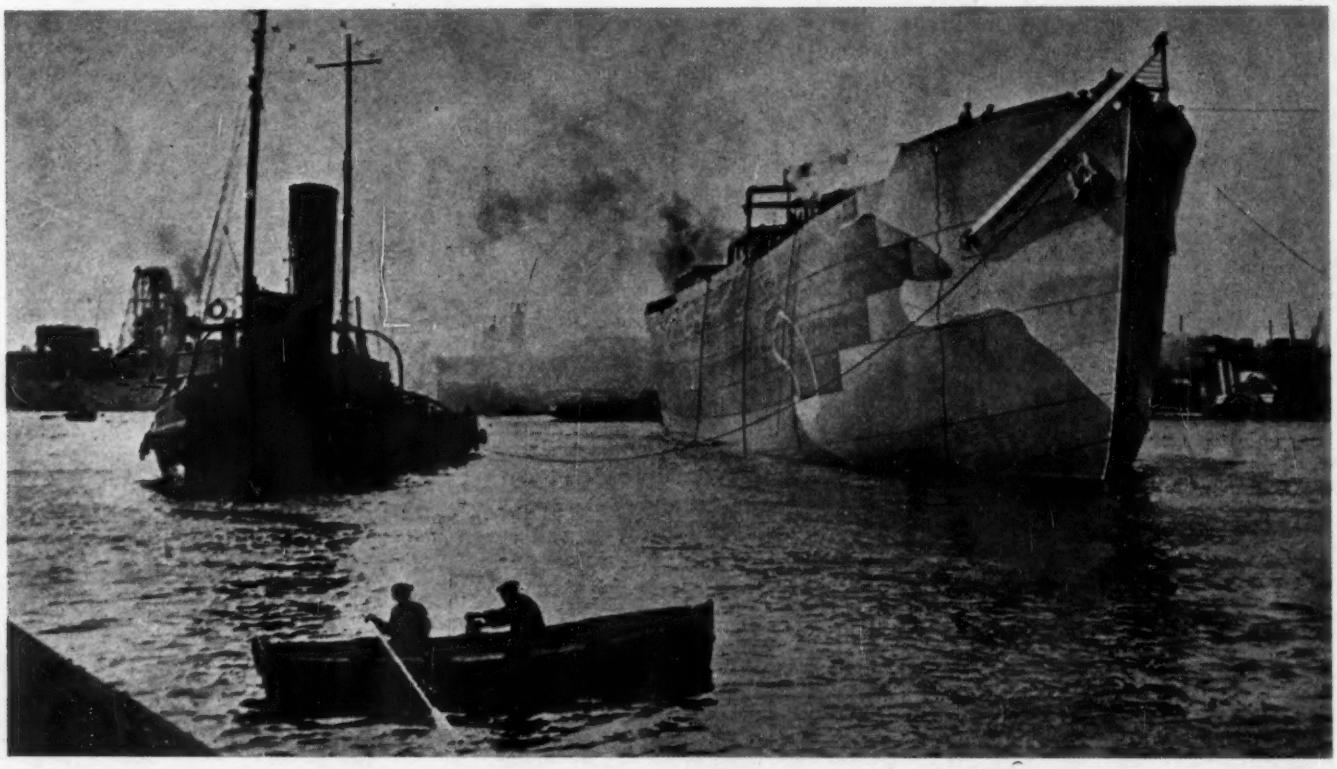
fouling. The more important of these belong to two groups of animals, one of which (the hydroids) is related to the familiar sea-anemone, the other (polyzoa) being distantly related to marine worms. Both form soft, branching growths, easily mistaken for seaweeds, though if they are placed in water and examined with a lens, the branches are seen to be covered with what look to be minute, daisy-like flower heads, but which are really little gelatinous polyps whose tentacles move actively, expanding and contracting to capture their microscopic prey. Some hydroids which occur commonly on ships are sufficiently distinctive in appearance to have earned the name of "whiskers."

We then have shell fouling of such organisms as the barnacle of which there are many species, ranging in size when fully grown, from ¼ inch or less up to 2 or 3 inches in diameter. The molluscs which bore into submerged timber are commonly known as "shipworms." There are many different kinds, all closely related, and the best known is the common "Teredo." Finally, we have the "Gribble," a form of marine crustacean which will attack and destroy timber. Unfortunately, this article does not allow us to go into the detail of the so-called shell foulings.

Specialized Field

Now, we must deal with the remedy for such fouling and corrosive conditions; thus we have the function of an anti-fouling composition and an anti-corrosive composition.

While the manufacture of ships' bottom compositions is a branch of the paint industry, it is in a distinct and separate category, for these products are not really paints, but compositions



This photograph from a British shipyard is one of a scene which happens every day in these islands. Her tugs have the newly launched freighter in tow to the fitting-out basin. Note camouflaging on the hull. Output from Canadian shipyards is steadily increasing, every unit destined to play a vital role in the Battle of the Atlantic and other zones.

designed for conditions very different from ordinary painting practice. A study of marine biology shows that to be effective, an anti-fouling composition must be able to kill the marine organism while still in the embryonic condition. As soon as a growth has definitely established itself, its development cannot be arrested by means of anti-fouling compositions or any other practicable method, and when once started its growth is very rapid.

The principle underlying the use of anti-fouling compositions is that by the slow and constant solution of the toxic bodies they contain, the ship's surface is kept in an antiseptic condition.

Science of Composition Manufacture

The anti-fouling film is a store for poisonous materials which are constantly being dissolved by the sea. The antiseptic surface desirable is thus supplied, but only at the expense of the store. In other words, it must of necessity be a wasting process. The quality of the paint is dependent on adjusting the rate at which this solution takes place to suit conditions. Two compositions may contain identically the same quantities of mineral poisons, but while one functions satisfactorily, the other may be a complete failure. This failure may be due to two causes —the paint film may possess such little resistance to water that its store of poisons is depleted too rapidly, or the film may be waterproof, the store remaining unattacked and little or no poison going into solution. Control of the rate of solution is obtained by the use of the proper medium for forming the paint film, and herein lies the science of composition manufacture.

The poisons in common use are derived from copper and mercury. Many different compounds of these two metals are used by various manufacturers who are guided in their selection of the most suitable by their experience. Arsenic is also frequently employed, but has not found great favor with the majority of makers. Surprising as it may seem, arsenic is not so poisonous in its effect on marine organisms as on higher biological orders.

Anti-corrosive Primer

So much for anti-fouling compositions. But to obtain the full efficiency from anti-fouling paints which possess delicately balanced chemical and physical properties that enable them to discharge their poisons at the correct rate and strength, it is essential that they should be applied over a properly prepared surface. And here, we come to the importance of anti-corrosive paint as a priming coat.

Research has shown that corrosion of steel surfaces is largely due to a difference of electric potential between adjacent points. This difference of potential may be due to uneven distribution of components (steel contains small percentages of various substances besides iron) or to difference of tension, etc. The rule is that where such difference of potential exists, a current will pass from the higher to the lower whenever an electrolyte (a liquid capable of conducting the current) connects them. Ordinary moisture is sufficient for the purpose but sea-water is a natural electrolyte. This is approximately the meaning of the term "electrolytic or galvanic action" so often applied to corrosion on the underwater bodies of many ships.

This action is also caused when two different metals, such as copper and steel, are immersed close together in salt water. The weaker metal (the steel in this case) is corroded away by the galvanic action. If, however, a zinc plate is immersed close to the other metals, the zinc will be corroded away as it is weaker than the steel. This is precisely the reason for attaching zinc plates to the stern sections of steel vessels having bronze propellers in order to remedy, to some extent, the galvanic action.

Inhibitive Paint

Another remedy may be found in the application of an inhibitive paint, so constituted that it will resist or inhibit local electrolysis in the presence of an electrolyte. To be effective on the underwater bodies of steel vessels, however, such a paint must contain properties that are insoluble in salt water.

It is essential that anti-fouling and anti-corrosive paints be quick drying so as to speed the boat through dry-dock which is so important at the present time when all bottoms are needed to convey materials to the war fronts on the seven seas, and the time spent by these boats when in dry-dock for repainting is lessened by such properties in anti-corrosive and anti-fouling compositions.

You will note that we have dealt in this article primarily with the bottom painting of ships. We have done this because, in our estimation, the most important part of ship protection is for anti-corrosive and anti-fouling purposes below water.

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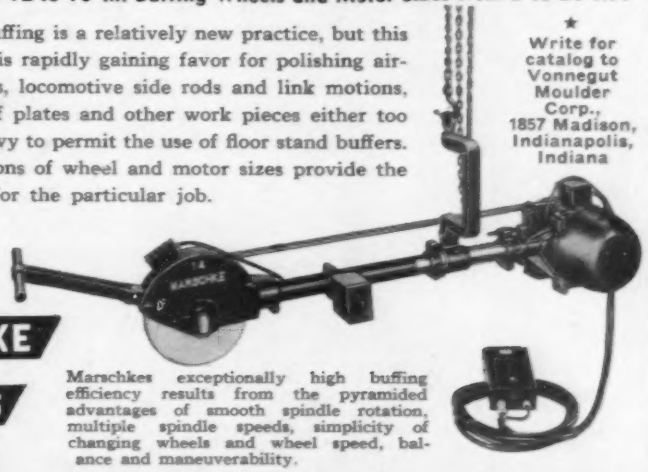

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(*Continued from page* 57)

Lubricator

Device for automatic application of controlled amounts of lubricants to bearings of conveyor trolley wheels. Useful for conveyors passing through drying and baking ovens. Device eliminates drip and consequent work spoilage, reduces maintenance costs. **481.**

Masking Paper

Ready-to-apply masking paper with gummed single or double edge. Paper treated to resist finishing materials. Saves time over the use of separate paper and tape. **260.**

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Standard and special sizes and shapes of adhesive backed stickers for masking areas of parts to be finished. Applied without moistening to most surfaces. Easily removed and will not pop off under heat. **62.**

Metal Treatment

Treatment for galvanized metal to insure proper adhesion of finishes. Properly treated areas develop dark tint while untreated areas remain bright. Suitable for immersion or hand application. **689.**

Mixers

Heavy-duty air-driven mixers for mixing and agitating finishing materials. Motors cannot be overloaded or burned out and will not stall. Models of ⅓ and 1 h.p., equipped with gear reduction drive and adjustable shaft length, are available. **481.**

Mobilometer

Determines mobility of a material by observing time required for a standard disc to descend a fixed distance through the sample. **827.**

Ovens

Electrically heated ovens for finish testing laboratories. Sizes from 13 in. x 13 in. x 13 in. to 37 in. x 25 in. x 37 in. Temperatures from 302° to 500° F. Fitted with air circulating fans, accurate temperature controls and other features. **546.**

Paint Remover

Non-flammable. Harmless to skin and safe under ordinary ventilating conditions. Contains no wax. **827.**

Paint Type Marker

Paint type crayon for marking metals. Comes in four colors and black and white. Remains legible in spite of weathering. **826.**

Pebble Finish

Pebble finish, applied by spray, for items requiring high-speed textured surface. Pattern size may be varied by changes in gun adjustment and application technique. Available in colors. **482.**

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Machine for printing color bands, insignia, etc. on cylindrical surfaces. Uses liquid inks, either dye or pigmented colors. Produces up to 4,000 pieces under normal conditions. **260.**

Sander

Electric sander for heavy-duty service. Counterbalanced, vibrationless unit, compact in size and fitted with comfortable handle. Detachable sanding pad made flexible to permit sanding on curved or flat surfaces. **125.**

Shellac Alternates

Have appearance and masking qualities of shellac. One is a combination of East India gum and modified resins with viscosity of five-pound shellac; the other, a combination of natural gums and modified resins. May be reduced with alcohol. **827.**

Spray Guns

Spray guns of plastic bodies. Lighter than aluminum bodies by a quarter of a pound, an important factor in reducing fatigue. Plastic is resistant to chemicals and unaffected by solvents and thinners. **125.**

Stripper

Phenolic stripper for removing organic finishes. Used diluted with two or more parts of water at 150° - 200° F. Free rinsing. Leaves no residue. **762.**

Stripping Lacquer

Transparent stripping lacquer for protection of polished or easily marred surfaces. Supplied ready for use and may be applied by any of the usual methods. Dries to touch in five minutes and to handle in 15 minutes. May be stripped off in 30 minutes. Available in clear and transparent red, blue, green and yellow-green. **619.**

Spray Booth Coating

Powder, mixed with water, to allow easy spray booth cleaning. Paint adheres to dry coating which is peeled off to clean booth. **332.**

Spray Gun

Spray gun incorporating a button control for changing spray pattern quickly from fan to round shape. Pressing button produces round spray. Release of button returns spray to original fan shape. **331.**

Stop-off Paint for Heat Treating

Stop-off paint for selective carburization on steel parts in liquid carburizing baths. Protects threaded edges. Applied as paint. **826.**

Testing Tubes

Glass testing tubes, graduated from one to eight cubic centimeters, for use in paint testing laboratories for checking compatibility and solubility, settling rates, and similar procedures. Tubes combine the advantages of test tubes and graduated cylinders, thus saving money and time. **190.**

Toluol Replacements

Two hydrocarbon solvents—one aromatic, comparable with toluol, based on its nitrocellulose tolerance; the other having a nitrocellulose tolerance of approximately 80% that of toluol. Both evaporate rapidly and have strength and solvency. **827.**

Viscometer

Bubble type viscometer for determining the viscosity of heavy finishing materials. Set includes liquids of certified viscosity in matched glass tubes, with empty matched tubes for the materials to be tested. **190.**

Viscosimeter

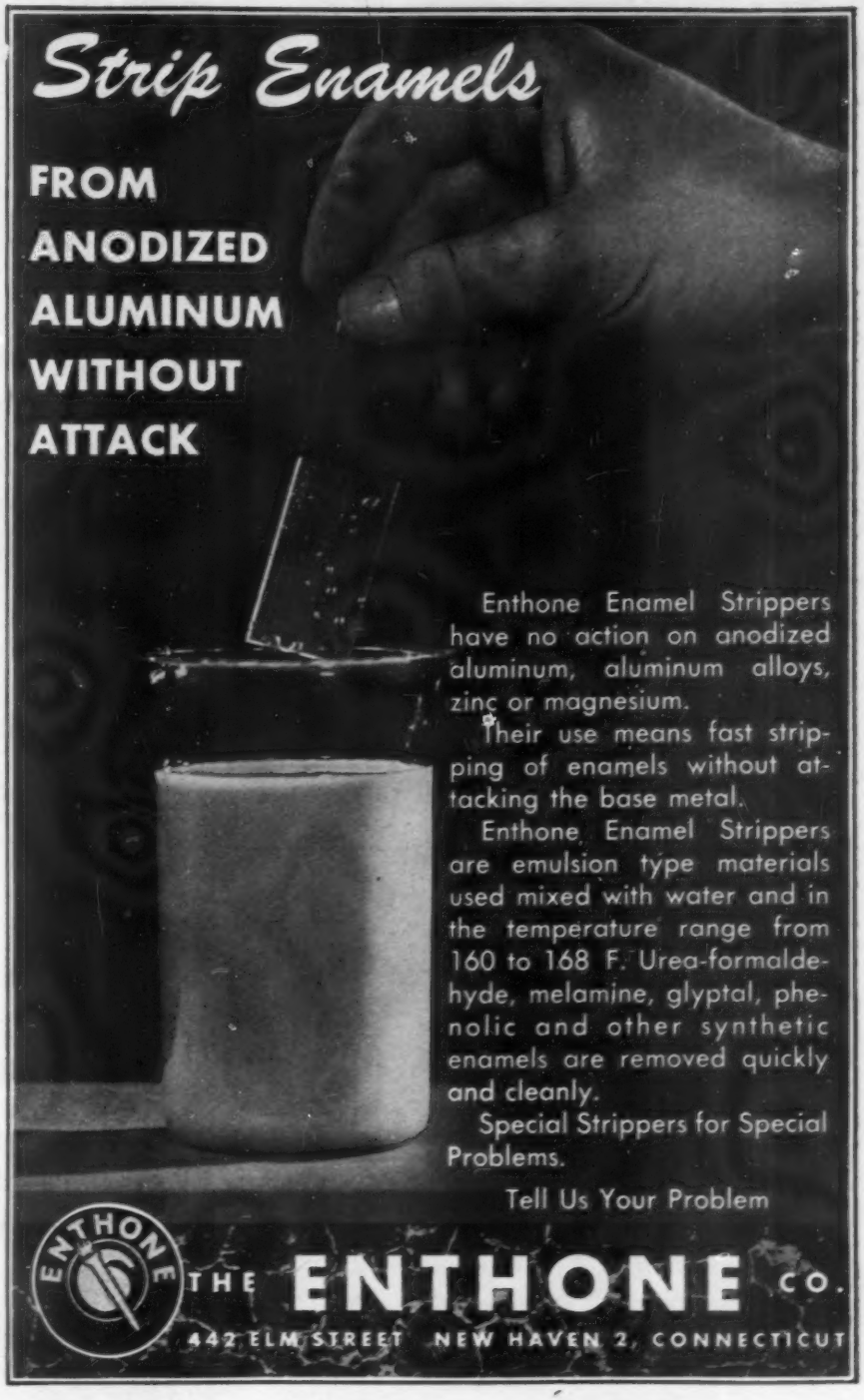
Consists of a bullet-shaped steel cup to be suspended in material to be measured by a looped handle equipped with a ring at the end. For reading, the cup is lifted out of the liquid and a timer is started as it leaves the surface. Liquid flows through orifice at bottom of cup and timer is stopped when stream flowing through orifice breaks. Time of flow indicates viscosity. **826.**

Water Paint

Quick-drying water paint of the resin emulsion type. Reduced for use with equal parts of water. May be applied over cement, brick, wallboard, etc. Available in soft shades. **190.**

Wrinkle Finishes

Wrinkle finishes containing no Chinawood oil. Closely resemble conventional finishes of this type. Applied and baked in regular manner. Available in colors. **619.**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Enthone Enamel Strippers have no action on anodized aluminum, aluminum alloys, zinc or magnesium.
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New Equipment

Rust Inhibitor

The Diamond Alkali Co., Dept. OF, Pittsburgh 22, Pa., has announced a new rust inhibitor especially suitable for shell cartridge cases.

Outstanding features of the new material are said to be the saving of time, the small cost involved, and the suitability of the protection before lacquering. The compound is used in an aqueous solution to inhibit the formation of rust on clean, pickled steel and is said to form a rust-free tight bond for the application of paint, varnish or lacquer.

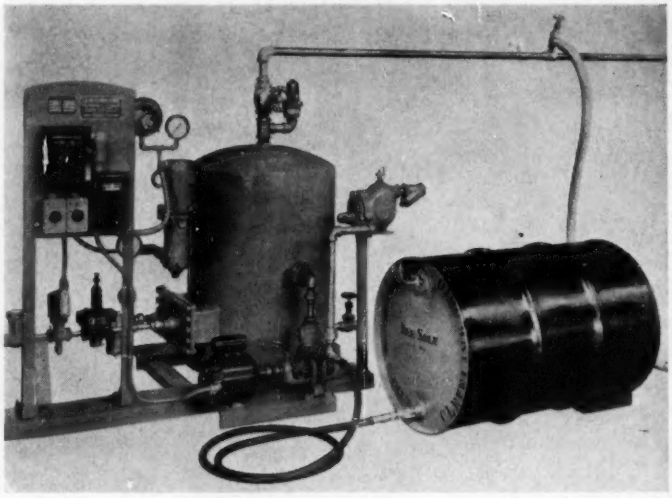
It has been found that no visible or measurable coating is deposited by the inhibitor and that its action is one of passivity. The solution, containing 14 oz. of material per 100 gal. of water, has a pH slightly above that of tap water.

According to the company, steel cartridge cases which have been processed with the rust inhibitor have withstood the salt spray, abrasive and firing tests of the Army. The new rust inhibitor was discovered following a request for a material which would not result in too much coating since the tolerances on steel shell cases are extremely small.

Concrete Sealer

Evercrete Corp., Dept. OF, 19 West 44th St., New York 18, N. Y., has announced a new concrete sealer, Rap-Id Seal. This material may be applied by brush or spray to any concrete or masonry surface. It is said to seal and waterproof the surface, lock in lime and alkalis and prevent paint deterioration caused by saponification. The material also serves as a prime coat.

Vapor Cleaner



Circo Products Co., Dept. OF, 2835 Chester Ave., Cleveland, O., have announced the new Model 35-S Dee-Tee Vapor Cleaner, illustrated at the left, for internal degreasing of differentials, transmissions, gear housings, transfer cases, lubricant reservoirs, containers, etc.

The manufacturers claim that the unit is always ready for instant use and will deliver a large volume of hot, clean solvent vapors, through a manifold to remote locations for thoroughly washing and rinsing inside surfaces free of worm lubricant, dirt, chips, etc.

Insulation covered flexible metal hoses and throttling valves are supplied to tap off the manifold at the various locations where degreasing operations are to take place. A system is included for returning to the vapor generator whatever solvent condensate collects in the manifold piping.

The solvent used is non-flammable and non-explosive and is stabilized for metal cleaning. Solvent supply to the unit is automatically pumped directly from standard containers in which it is originally shipped.

Ruggedly constructed and fully equipped with safety controls, the unit is fully automatic and does not require the attention of an operator. The Model 35-S is arranged to be heated by steam.

Other portable, electrically heated models are available.

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This Alvey-Ferguson machine was designed especially to speed-clean and speed-dry miscellaneous ball-bearing parts economically without the use of baskets. If you have a metal products cleaning and finishing problem write, without obligation today!

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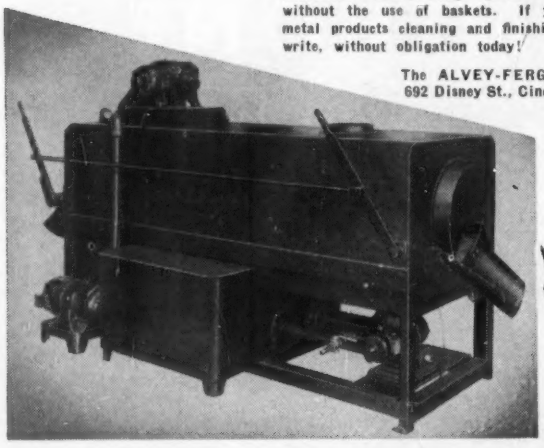

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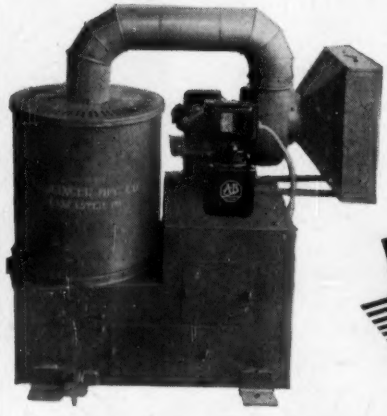

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First of a series of articles on the preparation of metal surfaces for protective finishes

PICKLE BATH TONERS

IMPROVED PICKLE SOLUTIONS PRODUCE BRIGHTER AND CLEANER WORK

Research Chemists in the American Chemical Paint Company laboratories, some years ago, made a valuable contribution to metal finishing which revolutionized the acid pickling of iron and iron alloys. The inhibitor—Rodine—which was developed at that time controls the pickling action to the removal of scale and prevents needless attack on clean metal. In addition to making it possible to greatly increase the speed of production, the savings in acid, metal, and the reduction of hydrogen embrittlement makes the use of Rodine standard in most pickling operations today.

In the continuing research on the pickling of metals, the ACP Laboratories have developed a further aid for pickling baths—"ACP Pickle Bath Toner" for use with or without Rodine. It fills a definite place in improving the finish of pickled metals and greatly reduces waste due to excessive dragout.

ACP Pickle Bath Toners are supplied in either a powder or liquid form for use in either sulphuric or muriatic acid solutions, producing brighter and cleaner surfaces. The emulsifying action of Pickle Bath Toners reduces the contamination of the pickle solution by oil, admirably adapting them to the pickling of work slightly oily and in conjunction with Rodine for the pickling of alloy steels that are difficult to pickle.

These Pickle Bath Toners, in both the powder and liquid grades, are furnished with and without inhibitor action. The uninhibited types are recommended where the advantages of the Pickle Bath Toner can be combined with the many advantages of the inhibitor, Rodine. In such cases the Toner *and* the Rodine are added to the new pickle bath and as future additions of acid are made only the Rodine is added.

In a few operations where strong inhibitor action is not required, for example in cold pickling solutions, or where actual attack or "etching" of the metal is wanted for subsequent operations, the use of the mildly inhibited form of Toner is recommended to obtain the improved cleaning action and still retain sufficient inhibition to prevent excessive etching.

Any sulphuric or muriatic pickle solution will be improved by the addition of ACP Pickle Bath Toner. Generally the powdered forms are recommended for use in sulphuric acid and the liquid forms for use in muriatic acid solutions. ACP Pickle Bath Toners are now supplied as follows:

Pickle Bath Toner No. 101—Powdered form without inhibitor for use with or without Rodine.

Pickle Bath Toner No. 102—Mildly inhibited powdered form for use without Rodine where but little inhibitor action is wanted.

Pickle Bath Toner No. 1—Non-inhibited liquid form for use with or without Rodine.

Pickle Bath Toner No. 2—Inhibited liquid form for use without Rodine where but little inhibitor action is wanted.

While ACP Pickle Bath Toners will be generally beneficial there are several operations where little inhibitor action is deemed necessary, including electroplating, galvanizing, pickling in cold solutions or in some electrolytic pickling units, etc. In addition, Pickle Bath Toners also improve the penetration, the wetting and the spreading action of zinc or ammonium chloride fluxes in preparation for galvanizing, tinning, etc.

Rodine
Makes Pickling Efficient
This steel surface photograph (magnified) was pickled in an uninhibited acid bath. Note the deep pits, and that the surface is visibly crystalline.
This surface pictured was pickled exactly like the other except that RODINE was added to the acid solution. Only scale pockets and roll marks are visible; no pitting occurred.

Steel requires pickling to remove scale whether the fabrication is for steel plates for battleships, airplane parts, motor vehicle or ordnance parts.

Rodine in the pickling bath confines the acid action to removing the scale and inhibits acid action on the clean metal. This controlling action of Rodine in preventing the acid from dissolving clean steel, saves acid by eliminating a needless waste. The life of the pickle bath is increased and better pickling is accomplished.

Our technicians are available to adapt Rodine or other ACP Products to your individual production problems. Time will be saved if you will give us as complete details as possible concerning your methods and requirements.

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
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☐ *Rodine*
☐ *Pickle Bath Toner* C-1

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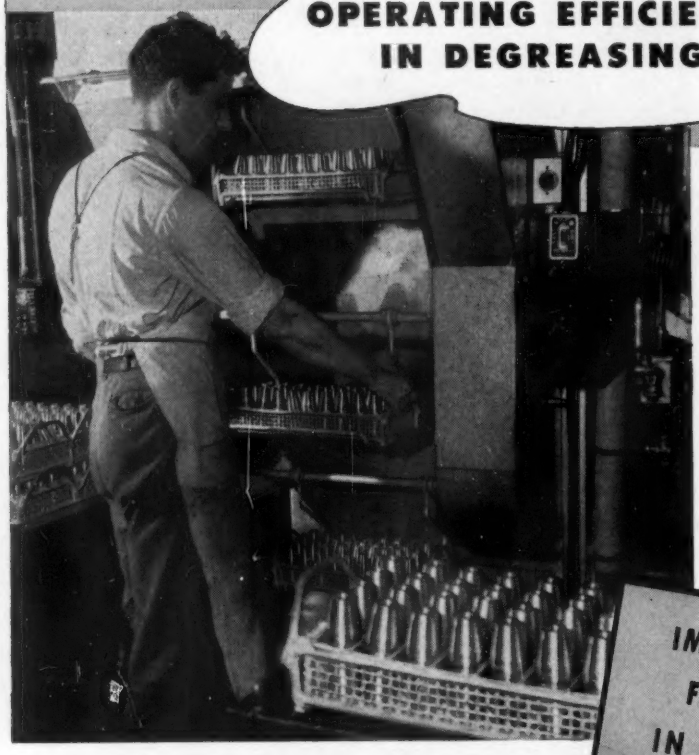
MAXIMUM OPERATING EFFICIENCY IN DEGREASING



As with any mechanical equipment, degreasers must be properly installed, operated and maintained. While the majority of manufacturers using degreasers have personnel capable of proper handling of the machines, some details may be overlooked with a resulting loss in operating efficiency.

Detrex Service Men cooperate with and instruct the engineers, chemists and operators responsible for your metal cleaning. Among the factors which they cover are those listed at the right. This continuous "follow through" is available to all Detrex customers.

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- Proper Speed of Work Through Solvent Vapor Zone

DETREX CORPORATION

DETROIT 27, MICHIGAN

WAR BONDS—TODAY'S BEST INVESTMENT

Manufacturers' Literature

Resin Booklet

A technical booklet reporting on the use of Lewisol maleates in protective coatings has been issued by the Synthetics Department of *Hercules Powder Co.*, Dept. OF, Wilmington, Del. Copies of the booklet may be obtained upon request.

The Lewisols are described as hard resins, made by modifying rosin esters with maleic alkyd compounds, in common with other hard resins of the rosin ester group. They are primarily intended for compounding with film-forming materials such as the cellulose derivatives, or with drying oils to achieve gloss and hardness, and in most cases to improve adhesion.

The booklet discusses the contributions of the Lewisols to the properties of varnishes and lacquer coatings. Various varnish preparations incorporating these resins are given, citing proportionate compositions, cooking procedure, and the test characteristics of the finished varnish.

Various tables give the properties of typical Lewisol maleate resins—melting point, color, acid number, weight per gallon, viscosity in typical solvents, and density. In addition to their basic resin functions, the booklet states, the Lewisols serve to control the viscosity of varnish and other compositions; to control the speed of solvent release, especially from lacquers, and to control the after-yellowing in white oleoresinous and lacquer enamels.

Paint Spraying Rules

A wall chart of paint spraying rules showing how to save paint, air, time, power, fuel, and equipment, reduce time lost because of sickness or accident, and improve results, has been published by the *Eclipse Air Brush Co.*, Dept. OF, 400 Park Ave., Newark 7, N. J. These rules apply to all types of spray equipment, not necessarily to that made by Eclipse. This chart will be sent free to any one requesting it.

Coating Catalog

A 16-page catalog describing corrosion-proof, non-contaminating plastic coatings for use in dairies, breweries, laundries, etc. has been issued by the *American Pipe and Construction Co.*, Amercoat Div., Dept. OF, P. O. Box 3428, Los Angeles, Calif. The catalog describes the characteristics, properties and uses of Amercoat coatings and gives complete instructions for their application to wood, metal, concrete, plaster, and other surfaces. The catalog is attractively printed and bound and is profusely illustrated with pictures of commercial installations.

Accompanying the booklet is a seven-page report on the results of numerous tests on the coatings with a variety of organic and inorganic chemicals, salt and tap water, foods and beverages.

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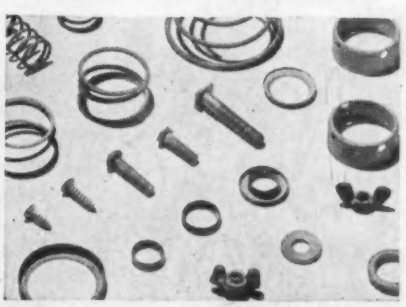

STEEL PROTECTION & CHEMICAL CO., INC., Mooresville, Indiana

« « ODDS and ENDS » »

After-The-War Dep't:

The following is a slightly expurgated version of a gag letter going the rounds. Possibly some of you, our esteemed readers, haven't seen it. (No, copies of the original are not available from this office. Please do not ask.) The letter:

To my customers:

Due to my independent position as a salesman, I have decided to show the products of the company which I represent at a time best suited to my convenience.

At the moment it pleases me to permit you to view my merchandise at my office on Wednesdays between 2:00 and 4:00 p.m. This will allow me to begin and end my weekends as I want them and will also permit me to devote Wednesday mornings to rest and recreation.

Very truly yours,
I. M. Asalesman.

P.S.: The above regulation applies only as long as there is a scarcity of materials due to the war. After the war I will be around as usual, my old subservient self.

I. M. A.

Note to subscribers: For a small fee we will allow you to read the original the next time we see you.

Things We Never Knew Until Now:

The fair sex purchased 325,000 gallons of nail polish during 1942—or we presume it was all purchased by the fair sex! And if readers wish to start a fight with their wives, they should ask them what they pay for nail polish and then tell them what finishers pay for lacquer.

Only five pounds of bristles, suitable for paint brushes, are obtained from 1,000 domestic hogs. The Chinese hog produces ten times this amount.

We're not so smart! We always thought that using aluminum paint on radiators improved the operation and resulted in higher heat radiation, but we learn by reading our favorite journal (Yes, we do read *Metal Finishing*) that it radiates less heat than a non-metallic paint.

An item that will interest the boys who are repainting all those used bottle caps is that the amount of steel used for caps is about equal to the amount used for the manufacture of automobile bodies. Seems hard to believe, doesn't it?

Paint has been made from *sewage* in Britain. We don't care—as long as it smells like *paint!*

Thought of the Month:

Experience is the name men give to their mistakes.

Notes From The News:

By way of the Canadian Paint and Varnish Magazine we learn that Massachusetts is going to put 7,500 gallons of luminous paint along the middle of 500 miles of highway in an attempt to lessen the dangers of dimout driving. Whether or not the idea is a good one we are not prepared to say. However, the cost of the project bothers us a little. No paint is cheap, as you have probably found if you have had your house painted or your car refinished. We were under the impression that luminous paint is just plain expensive. We may be off base but it is our thought that Mr. John Taxpayer in Massachusetts will surely give out with a long and loud beef if the cost of the 7,500 gallons of luminous paint is anywhere near what we think it is.

Come to think of it, since we've gotten started on the subject, we might as well continue for the enjoyment(?) of the organic finishers.

Everyone knows that black paint will absorb heat but we just read of the most elaborate use of this principle for practical purposes. Thirteen years ago Capt. H. Wheeler, whose ship was icebound on Lake LaBarge, 29 miles from the headwaters of the Yukon River, painted a strip 40 feet wide the full distance of 29 miles using a mixture of lampblack and thin refuse oil, which was applied to the ice with ordinary household brooms. The ice under the black strip melted three weeks earlier than the surrounding ice with the arrival of Spring and Capt. Wheeler's steamboat sailed through the channel thus formed.

I cannot say how the truth may be.
I say the tale as t'was told to me.
Scott.

"I KNEW HE WOULDN'T COME ... HE NEVER TAKES A DAY OFF!"

Christmas Greetings

Christmas greetings were received from the following:

Adhere, Inc.
Agate Lacquer Mfg. Co.
Rafael Ayala
H. Leroy Beaver
Best Mfg. Co., Inc.
Joe Barron, M. E. Baker Co.
Adolph Bregman
William Bruhns
Charvos, Inc.
D. X. Clarin, Oakite Products, Inc.
Samuel L. Cole, Chas. F. L'Hommedieu & Sons Co.
Harry N. Coleman, MacFarland Aveyard & Co.
Frank Connolly
Denham & Co.
John Dobson, The Cowles Detergent Co.
Domestic Novelty Co.
Mr. & Mrs. F. Fischer
General Electric Co.
H. B. Gordon
Green Electric Co.
Father Flanagan
George W. Grupp
Handy and Harman
Mr. & Mrs. Frank Hanlon
Mr. & Mrs. George B. Hogaboom
Mr. & Mrs. Zachary Irenas
Irving Trust Co.
Robert Jackson
Knapp Engraving and Knapp Color Plate Cos., Inc.
The Lea Mfg. Co.
Mr. & Mrs. Robert Leather
Luscombe Airplane Corp.
Mack Printing Co.
Maisto's, Inc.
Marmon-Herrington Co., Inc.
Wilfred S. McKeon, Sulphur Products Co. Inc.
Metaplast Corp.
Thomas E. Miller, Hercules Powder Co., Inc.
Alfred W. Payson, Michigan Buff Co.
Philadelphia Quartz Co.
R. E. Powers, B. F. Goodrich Co.
Andrew V. Re
Herbert B. Sell
O. S. Tyson & Co., Inc.
United Engineering & Foundry Co.
Universal Engraving Co.
Mr. & Mrs. Lionel deWaltoff
Mr. & Mrs. Ed. Washburn
Philips Webb Utham Advertising Agency
Samuel Wein
Thomas A. Weiss
West Virginia Pulp & Paper Co.
Westinghouse Electric & Mfg. Co.

Thank you! And Cordial Greetings and Best Wishes to All Our Friends